1978 C-b ANNUAL REPORT

VOLUME I

SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

C-B SHALE OIL PROJECT

OCCIDENTAL OIL SHALE, INC., LESSEE

751 HORIZON COURT

GRAND JUNCTION, COLORADO 81501

APRIL 20, 1979

1978 C-b ANNUAL REPORT

VOLUME 1

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April 20, 1979

Submitted by:

C-b SHALE OIL PROJECT
OCCIDENTAL OIL SHALE, INC., OPERATOR
751 Horizon Court
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to:

Mr. Peter A. Rutledge
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Grand Junction, Colorado 81501

C-b Shale Oil Project
Occidental Oil Shale, Inc.

FOREWORD

The 1978 C-b ANNUAL REPORT is submitted to fulfill the requirements of the Oil Shale Lease as stated in Section 16(b) of the Lease, Section 1.(C)(4) of the Lease Environmental Stipulations, and Condition of Approval (No. 3) of the Detailed Development Plan. This report consists of the following volumes:

Volume 1	-	Summary of Development Activities, Costs and Environmental Monitoring
Volume 2	-	Environmental Analysis
Appendix 2A	-	Volume 2 Supporting Data
Appendix 2B	-	Volume 2 Time Series Plots

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1978 C-b ANNUAL REPORT

VOLUME 1

SUMMARY OF DEVELOPMENT ACTIVITIES, COSTS AND ENVIRONMENTAL MONITORING

Part 1 - Development Activities and Costs

1.0 INTRODUCTION TO PART 1

The following report is a brief descriptive overview of development activities and costs on the Federal Oil Shale Lease Tract C-b during calendar year 1978. This presentation closely follows the outline of the Detailed Development Plan (DDP) and its modifications (DDPM) for ready cross-reference. In many areas, as detailed in the DDP, more activities will be undertaken as the Tract development progresses. A chapter on compliance with the environmental control plans is included.

A pictorial section showing site preparation and construction at various stages is attached. It is keyed to the written description for easy reference.

1.1 Project Background

During the 50 years following the inclusion of oil shale in the Federal Mineral Leasing Act of 1920, no Federal oil shale lands were leased to the public. In early 1971 the states of Colorado, Utah and Wyoming submitted reports to the Secretary of the Interior on expected economic and environmental effects of the development of oil shale in those states. Later the same year, the Secretary of the Interior announced plans for a proposed Federal Prototype Oil Shale Leasing Program. From mid-1971 through 1973 a number of activities preliminary to a decision to proceed with the proposed program took place. Those activities included: conducting an exploratory core drilling program, nomination of proposed lease tracts by the public, establishment of a federal oil shale task force comprised of representatives from federal, state and local governments, and the preparation and publication of a draft and Final Environmental Impact Statement by the Department of the Interior in accordance with the provisions of the National Environmental Policy Act. Following the publication of the Final Environmental Statement for the Prototype Oil Shale Leasing Program in August 1973, the Department of the Interior published its intent to offer for lease two oil shale tracts in each of the states of Colorado, Utah and Wyoming. Each tract comprised no more than 5120 acres.

1.2 Project Overview

The goal of the leasing program is to: "... provide a new source of energy for the nation by stimulating the timely development of commercial oil shale technology by private enterprise, and to do so in a manner that will assure the minimum possible impact on the present environment while

providing for future restoration of the immediate and surrounding area."

The Leasing Program also established the following objectives:

- provide a new source of energy that will increase the range of energy options available to the nation by stimulating the timely development of commercial oil shale technology by private industry;

- insure the environmental integrity of the affected areas, and concurrently define, describe, and develop a full range of environmental safeguards and restoration techniques that can be reasonably incorporated into the planning for a possible mature oil shale industry in the future;

- permit an equitable return to all parties in the development of this public resource; and

- develop management expertise in the leasing and supervision of oil shale resource development in order to provide the basis for future administrative procedures.

Commencing with competitive bids in January 1974, the Department of the Interior offered for lease the six selected tracts in Colorado, Utah and Wyoming, and during the following six months leased four of these tracts, two each in Colorado and Utah. Neither of the two Wyoming tracts received acceptable bids.

2.0 DESCRIPTION OF PROJECT AREA

Federal Oil Shale Tract C-b is located in the Piceance Creek structural basin between the Colorado River on the south and the White River on the north. It is dominated by a large central plateau which represents more than 75% of the basin's land surface. The Tract consists of 5,093.9 acres, more or less, which is shown in Figure 2-1 and is located in Rio Blanco County, Colorado as follows:

T. 3 S., R. 96 W., 6th P.M.

Sec. 5, W½ SE¼, SW¼; Sec. 6, lots 6 and 7, E½ SW¼, SE¼; Sec. 7, lots 1, 2, 3, 4, E½W½, E½; Sec. 8, W½ NE¼, NW¼, S½; Sec. 9, SW¼, Sec. 16, NW¼, W½ SW¼; Sec. 17; Sec. 18, lots 1, 2, 3, 4, E½ W½, E½.

T. 3 S., R. 97 W., 6th P.M.

Sec. 1, S½; Sec. 2, SE¼; Sec. 11, E½; Sec. 12; Sec. 13, N½; Sec. 14, N½ NE¼.

The Tract is located in a sparsely populated region of Rio Blanco County in the Piceance Creek basin in northwestern Colorado. Terrain on the Tract consists primarily of undulating valleys and ridges trending in a northeasterly direction and draining into Piceance Creek. The northern edge of the Tract is approximately one-half mile south of Piceance Creek between Willow Creek and Stewart Gulch. Piceance Creek then flows northwesterly approximately 24 miles to its confluence with the White River. Irrigated-grassland ranching predominates along Piceance Creek. The towns nearest to the Tract are Meeker (40 miles), Rifle (40 miles) and Rangely (65 miles).

Elevations on the Tract vary from 6400 feet in the lowest valley bottoms to 7100 feet on the ridges at the southern edge of the Tract. The climate is semiarid with snow cover occurring variably from October to May. The climate supports sparse vegetation, with sagebrush and pinyon-juniper communities being dominant. Approximately 45% of the Tract (primarily the flat ridgetops) was chained by the federal government in 1967. Chaining is a technique designed to improve range production by removing sage and pinyon-juniper. Historically, the Tract has been used primarily for cattle grazing and providing winter range for mule deer.

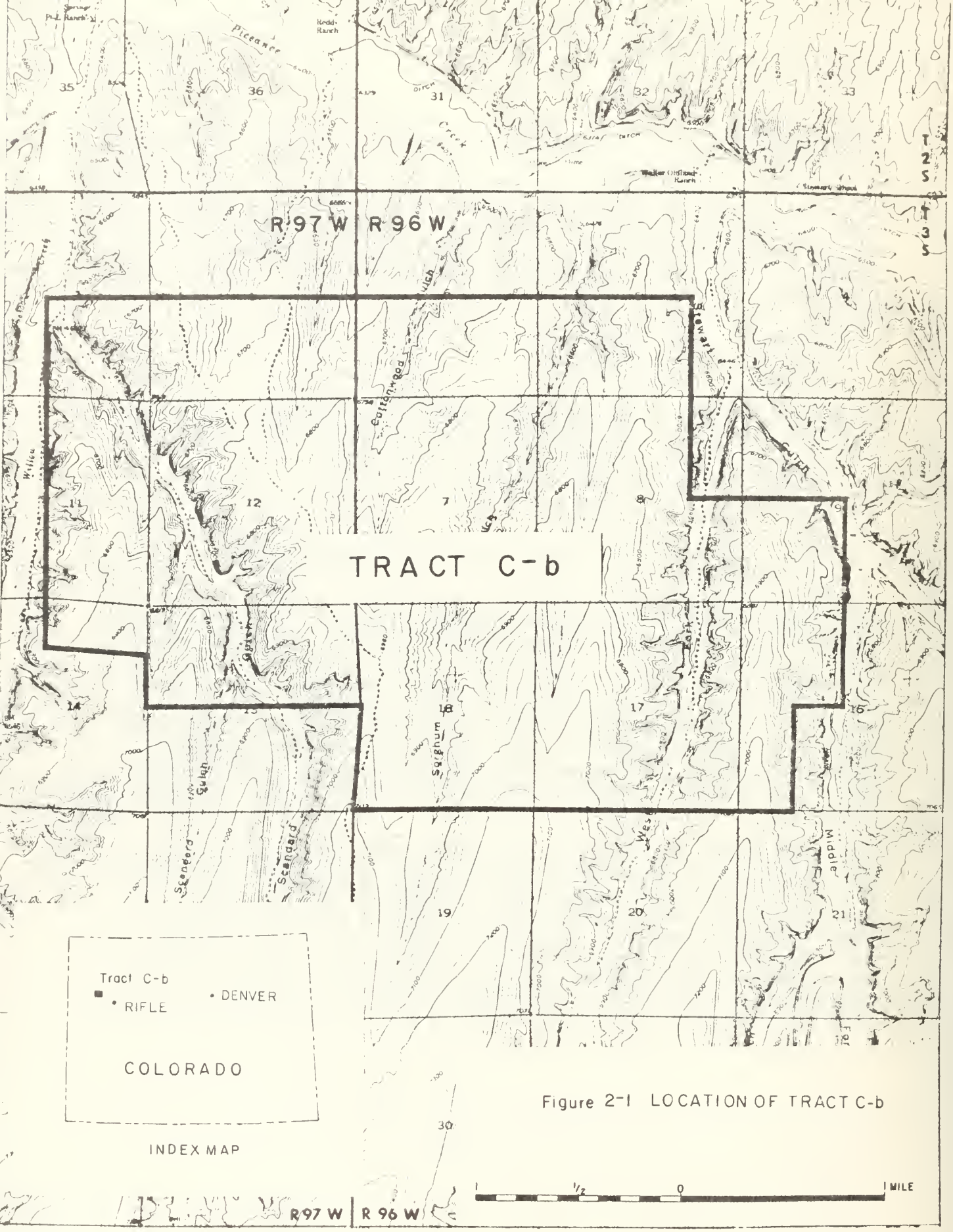

Figure 2-1 LOCATION OF TRACT C-b

3.0 SCHEDULE AND COSTS

3.1 Schedule

3.1.1 "Milestone" Schedule

The "milestone" schedule (Figure 3-1) submitted to and approved by the AOSO in early 1978 depicts 25 activities, grouped as follows: site preparation, preconstruction activity, preproduction mining, ancillary facilities, and commercial-facilities construction encompassing the time span from 1977 thru 1987.

The site preparation activity consists mainly of road construction and grading and fencing activities in late 1977 continuing through 1978; dam construction is projected for 1979.

The preproduction mining activity consists mainly of collaring the head frames and erection of hoist houses for the 15-foot diameter Vent/Escape shaft, the 29-foot Production Shaft, and the 34-foot Service Shaft in 1978. Sinking these shafts is projected through '82-'84, variable with each shaft. The 34-foot Off-gas Shaft is scheduled to be collared in 1982. The predevelopment mining span is shown covering 1982 thru 1986.

For the Ancillary Facilities, retort construction is shown beginning in early 1982 for the initial cluster with retort operation in 1984. A second cluster is scheduled for construction for mid-'83 through late '84 with operation beginning in late '84.

The Commercial Facility construction is initiated in mid-'83 with start of retort mining. General construction covers the span from mid-'85 to late '86 with commercial operations scheduled for start-up in early '87.

3.1.2 Schedule vs. Actual Activities in 1978

Figure 3-2 shows how site-preparation and construction activities in '77 - '78 compared with the previously developed milestone schedule for this time span.

3.2 Costs

1978 was the first full year of major construction development of the C-b Tract itself. During this year the construction activity went from a near-zero level to a large-scale effort involving as many as seven major construction contractors on site simultaneously, including major shaft-sinking activity. The engineering and design activity continued at about the same pace as in 1977, but the field-construction management effort developed into a major activity to keep pace with the tract construction development.

The 1978 C-b financial information is shown in Table 3-1 with costs broken down into the following categories: engineering design and construction, environmental, offsite development, and general and administrative. Of the $41,045,000 total costs in 1978, the engineering design and construction costs predominated.

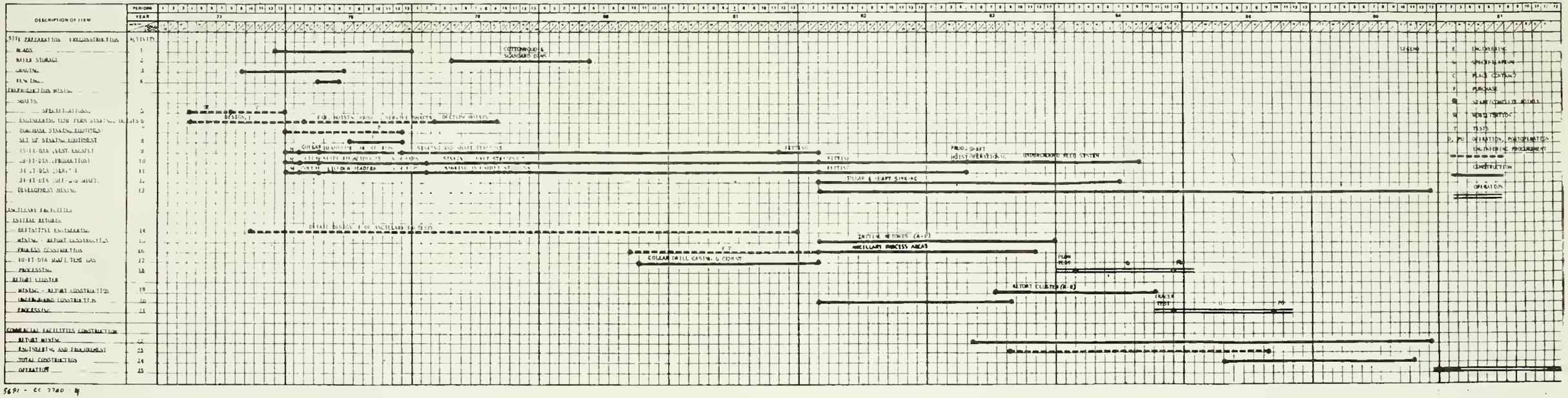

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FIGURE 3-1
OVERALL PROJECT GUIDE SCHEDULE

FIGURE 3-2
C-b SITE PREPARATION AND CONSTRUCTION
ACTIVITIES IN 1977 AND 1978

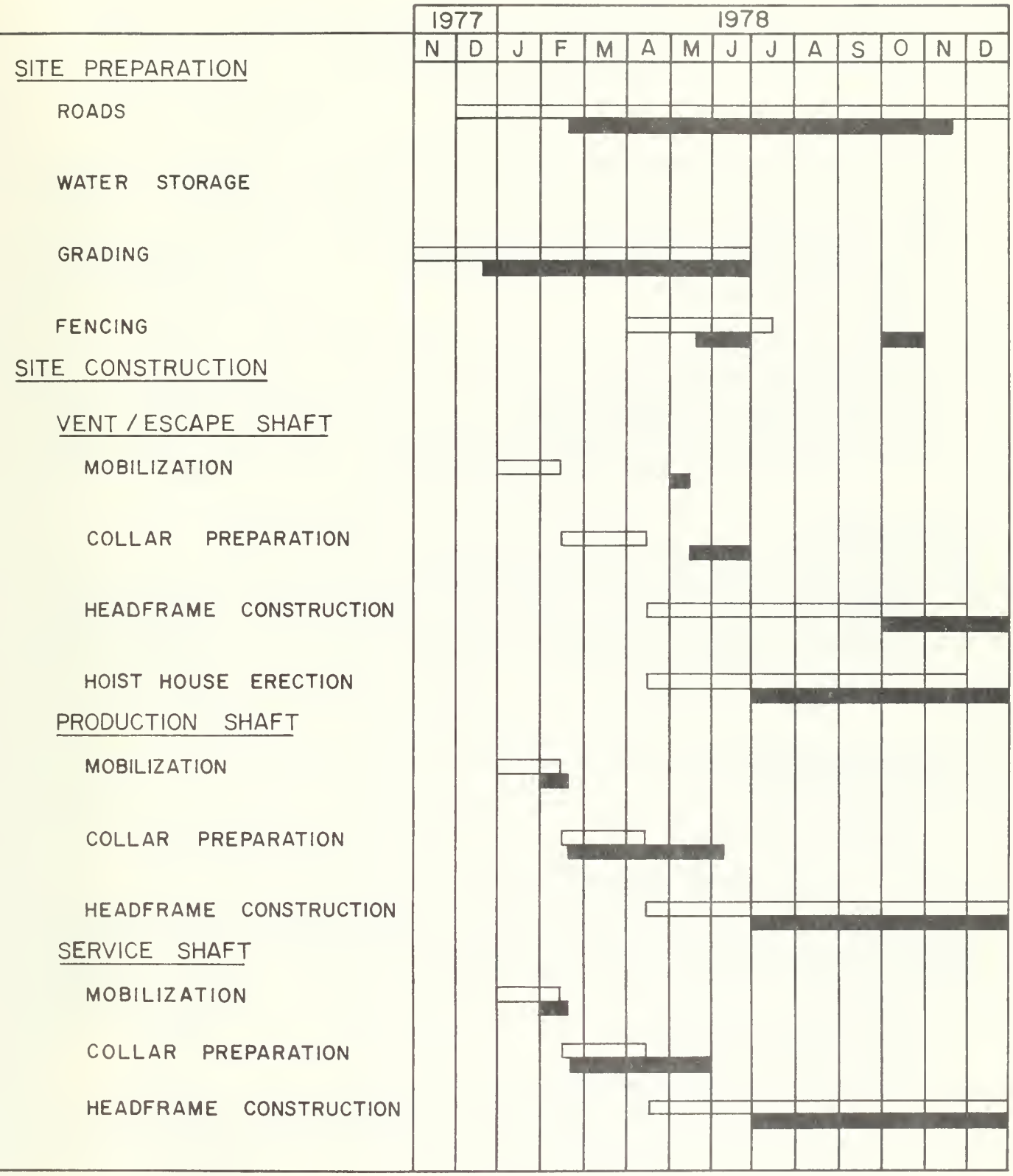


Table 3-1

C-b Shale Oil Venture

1978 Financial Information
Presented at actual 1978 Cost

($1,000's)

Engineering Design & Construction	
Engineering Design & Construction Management	$ 7,296
Shaft Construction	11,772
Headframe Construction	5,244
Shaft Hoisting Equipment	4,969
Site Preparation	2,485
Facility Construction	1,509
General Construction Support	1,678
C-b Tract Operation & Maintenance	1,272
Total Engineering Design & Construction	$36,225
Environmental	
Monitoring	$ 659
Reporting	5
Permits	32
Land and Water Right Acquisition	133
Total Environmental	$ 829
Offsite Development	
Housing	$ 191
Community Development	227
Total Offsite Development	$ 418
General & Administrative	
Staff Costs	$ 2,050
Office Expense & Overhead	534
Legal & Professional Fees	906
Other General & Administrative	83
Total General & Administrative	$ 3,573
Total C-b Project	$41,045

4.0 DEVELOPMENT ACTIVITIES

Major site development activities in 1978 consisted of preparation and construction of areas and facilities for shaft sinking and related activities.

4.1 Site Preparation

Photographs depicting site preparation activities are presented as a pictorial review at the back of this report. Site preparation entailed the clearing of vegetation, removal of top soil to stockpiles and excavation or fill work. Preliminary site preparation preceded construction of shaft headframes and supporting facility structures. The majority of preparation work was concluded by July 1978. Figure 4-1 shows the general location of each of the areas discussed below.

4.1.1 Mine Support Area

Preparation of the Mine Support Area began in late December 1977, and was the major earthwork activity during the first quarter of 1978. This area encompasses the Production and Service Shafts, laydown areas, Minehouse, office, maintenance facilities and Temporary Construction Facilities.

4.1.2 Ventilation/Escape Shaft Area

The V/E Shaft is located to the north of the main Mine Support Area and will be utilized for initial underground development work. A road was started into the area in January of 1978 and shaft preparation work begun. The area was readied for excavation of the shaft collar and foundation by April. Upon completion of the initial activities it will be utilized as a Ventilation and Escape Shaft as its name denotes.

4.1.3 Explosive Storage Area

An access road and storage area was prepared for the safe storage of explosives. Construction of this compound was completed in April.

4.1.4 Security Facility

An area was prepared for the future construction of a visitor and security center at the northern boundary of the Tract along the access road. A weigh station will be built in conjunction with this facility. The area is presently being used for transient-equipment parking. The security and visitor section is housed in a temporary building near the location of the future permanent facility.

4.1.5 Main Access Road

Preparation for construction of the main access road began in March 1978 and actual construction began in April. The main road accesses the property from the north via Piceance Creek road; it is an all-weather road.

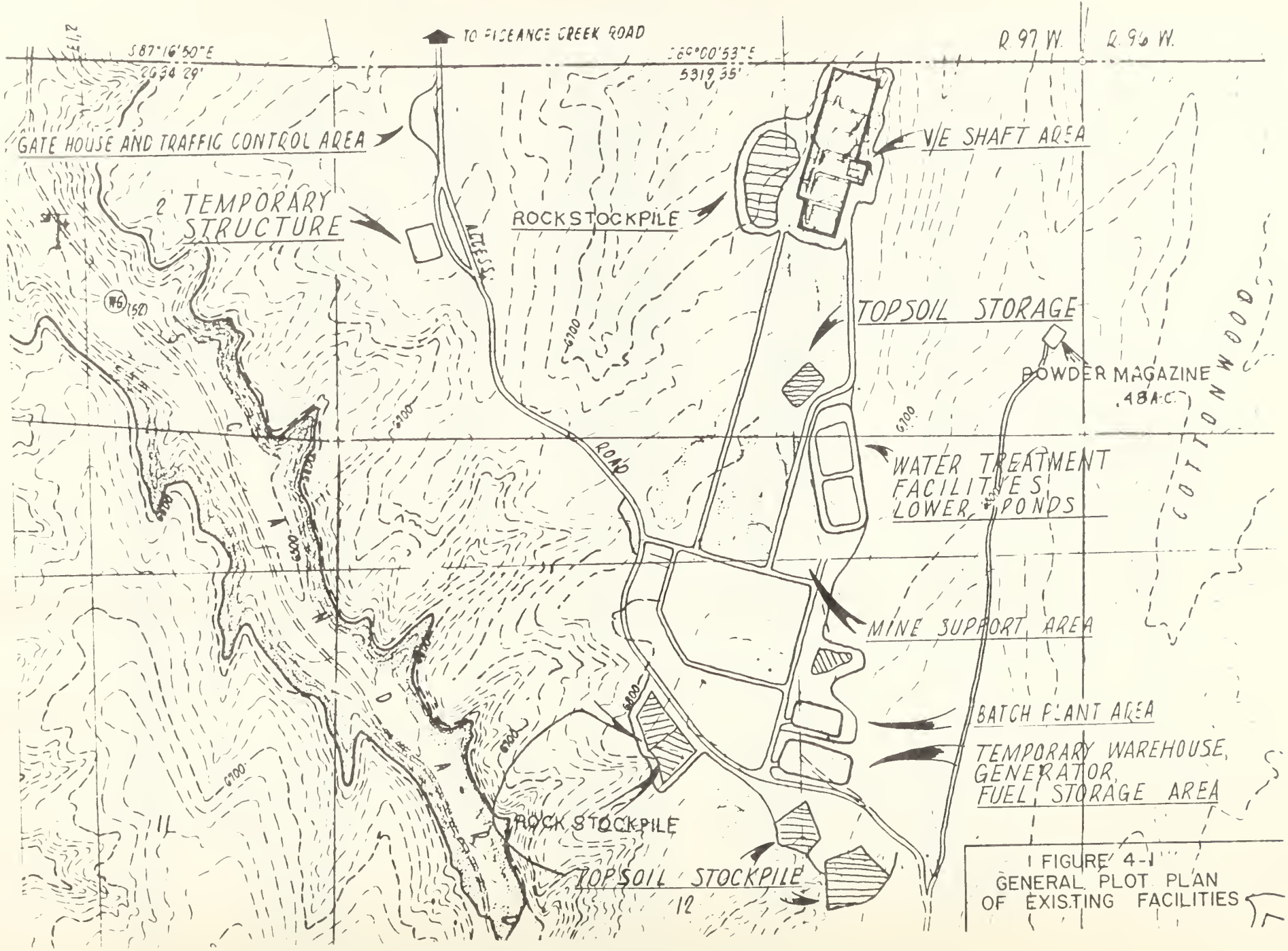


FIGURE 4-1
GENERAL PLOT PLAN
OF EXISTING FACILITIES

4.2 Site Construction

Construction activities followed completion of surface preparation in each respective area. A pictorial review of site construction activities is presented at the back of this report. The construction status of the various construction projects at year-end follows below. Figure 4-2 depicts the actual location of the various structures in the Mine Support Area. Figure 4-3 depicts those in the V/E Shaft Area. Legends are provided so that permanent structures may be distinguished from temporary construction facilities.

4.2.1 Production Shaft

The 29-foot diameter Production Shaft was begun in February and was "collared in" to approximately 70-foot depth by conventional excavation methods. The headframe of 313-foot height was "slipformed" during September and early October in 26 days. Slipforming is a method of continuous construction in which the form is slipped or jacked-up as the concrete is poured in place. The rebar is placed ahead of the advancing form. Steel beams and floors were installed as feeder and collar floors were completed. The roof and lower power floor beams were set and the sinking and service hoists have been installed. Both are housed in temporary metal buildings which were erected near the shaft. They will be used during shaft-sinking activities only. Mechanical and electrical facilities were nearing completion at year end. Earthwork in the vicinity of the headframe is completed with the exception of a small area around the manlift which has yet to be backfilled. The Production Shaft will serve as the main "muck"-hoisting facility during commercial operation. It is an exhaust structure for mine ventilation air.

4.2.2 Service Shaft

The 34-foot-diameter Service Shaft was "collared in" beginning in February to a depth of 65 feet. The collar and headframe foundations were completed in May. The slipforming took place in a 10-day period during August with installation of steel beams and floors in progress at year end. The man-loading and collar floor was completed with beams set in the roof, upper power floor, lower power floor and dump chute.

The dump chute and collar door have been installed. The sinking and service hoists were installed and a metal building erected to enclose them. The shaft-sinking mechanical and electrical facilities were near completion at year end. Earthwork was completed, except for around the manlift. The Service Shaft will be used for both men and equipment hoisting and as a fresh-air ventilation intake. The air inlet or "air tunnel" to the Service Shaft was completed during August; it enters the Service Shaft some 100' below grade.

4.2.3 Ventilation/Escape Shaft

The 15-foot diameter Ventilation Escape Shaft was begun in May. The collar and headframe foundation was completed in June. The structural steel

headframe has been erected and the siding and dump-chute installation was begun. A metal building to house the shaft sinker's shop and dry room was also erected.

The V/E Shaft hoisthouse was begun during July. The building itself was completed in December. Installation of mechanical/electrical facilities were near completion at year end.

4.2.4 Temporary Power Generation for Shaft Sinking

The foundation for ten generators has been completed and the building to hoist them erected. Four generators and five radiators are in place at this time. Installation of control panels, transformers, switchgear and piping are nearing completion. Power distribution lines were completed to the V/E Shaft and Service Shaft. Installation of the natural gas pipeline to fuel the generators has begun. This facility is being constructed for the generation of power during the shaft-sinking phase of work only.

4.2.5 Concrete Batch Plant

The Permanent Batch Plant was operational in time for major concrete usage during slipforming and is presently receiving further winterizing. It was necessary to install a batch plant on site because of the remote location and large volume of concrete needed in construction and future mining operations.

4.2.6 Shaft Dewatering

Contracts have been signed and work has begun on two 5-acre-foot ponds and facilities for water disposal during shaft sinking. See Figure 4-2.

4.2.7 Temporary Facilities

Many temporary buildings and facilities have been erected on the site to service the immediate needs of construction activities. As manpower on site increases these facilities will be replaced with permanent installations. Temporary offices have been moved to a location overlooking the Production Service Shaft area. Emergency-Vehicle Buildings were erected near the office and in service by September. The Temporary Construction Warehouse was completed in September and is in use. The Generator Building was operational by August and used for surface power requirements, such as the batch plant operation, heating and lighting.

4.2.8 Power Lines

All construction power lines are essentially complete at this time. Additional lines may be required as to meet future development.

N 7,500 N 8,000 N 8,500 N 9,000 N 9,500 N 10,000 N 10,500

E 17,000 E 16,500

E 13,500 E 13,000 E 12,500

E 15,500 E 15,000

Z PLANT 18° GRID NORTH

MATCH LINE

CONVEYORS FOR SPOIL DISPOSAL AREA

TOPSOIL STOCKPILE

ROCK STOCKPILE

CAR WASH

CONCRETE TRUCK WASHOUT PIT

ENST POWER

EXIST ROAD

45,000 GAL WATER TANK

LOW POUR PT (DIESEL)

33,500 GAL DIESEL
10,000 GAL NO-LEAD
10,000 GAL REGULAR

TEMP BATCH PLANT

BATCH PLANT

40x60' CARPENTER SLAB

PREFAB PAD

PROPOSED GENERATOR BLDG

HOIST FOUNDATION

PRODUCTION SHAFT

WINCHES

STAGE WINCHES

SERVICE SHAFT

HOIST FOUNDATIONS

AIR TUNNEL

DRY

20,000 GAL WATER TANK

SHOP SLAB

OFFICE

STAIRS

BADGE ALLEY

FIRST AID

VISITOR'S PARKING

CONTRACTOR PARKING

REBAR STORAGE

"B" STREET E 16,115.00

"D" STREET E 15,590.00

"C" STREET E 15,564.00

"A" STREET E 15,145.00

"E" STREET N 9,460.00

"F" STREET N 9,660.00

HOLD

STRAIGHT RUN PIPE STORAGE

BASE MATERIAL STOCKPILE

CONTRACTOR GENERATOR BUILDING

E 15,285.00

ELECTRICAL CABLE & PLANT EQUIPMENT STORAGE

LAYDOWN & REBAR STRUCTURAL STEEL & PIPE SPOOLS O.S STORAGE

S 30°55'46" E 1,511'

SECURITY FENCE (TYP.)

ACCESS ROAD

METERING STATION

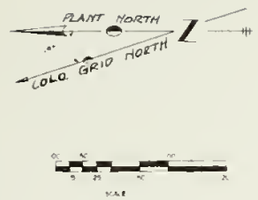
4" NATURAL GAS LINE

ACCESS ROAD

LEGEND

- (A) OXY / PARSONS OFFICE
- (B) SUB-CONTRACTORS
- (C) EMERGENCY VEHICLE SHELTER
- (D) TEMPORARY WAREHOUSE
- (E) TEMPORARY POWER GEN BLDG
- (F) DIESEL STORAGE TANKS
- (G) GASOLINE STORAGE TANKS

FIGURE 4-2
LOCATION OF FACILITIES
IN THE V/E SHAFT AREA



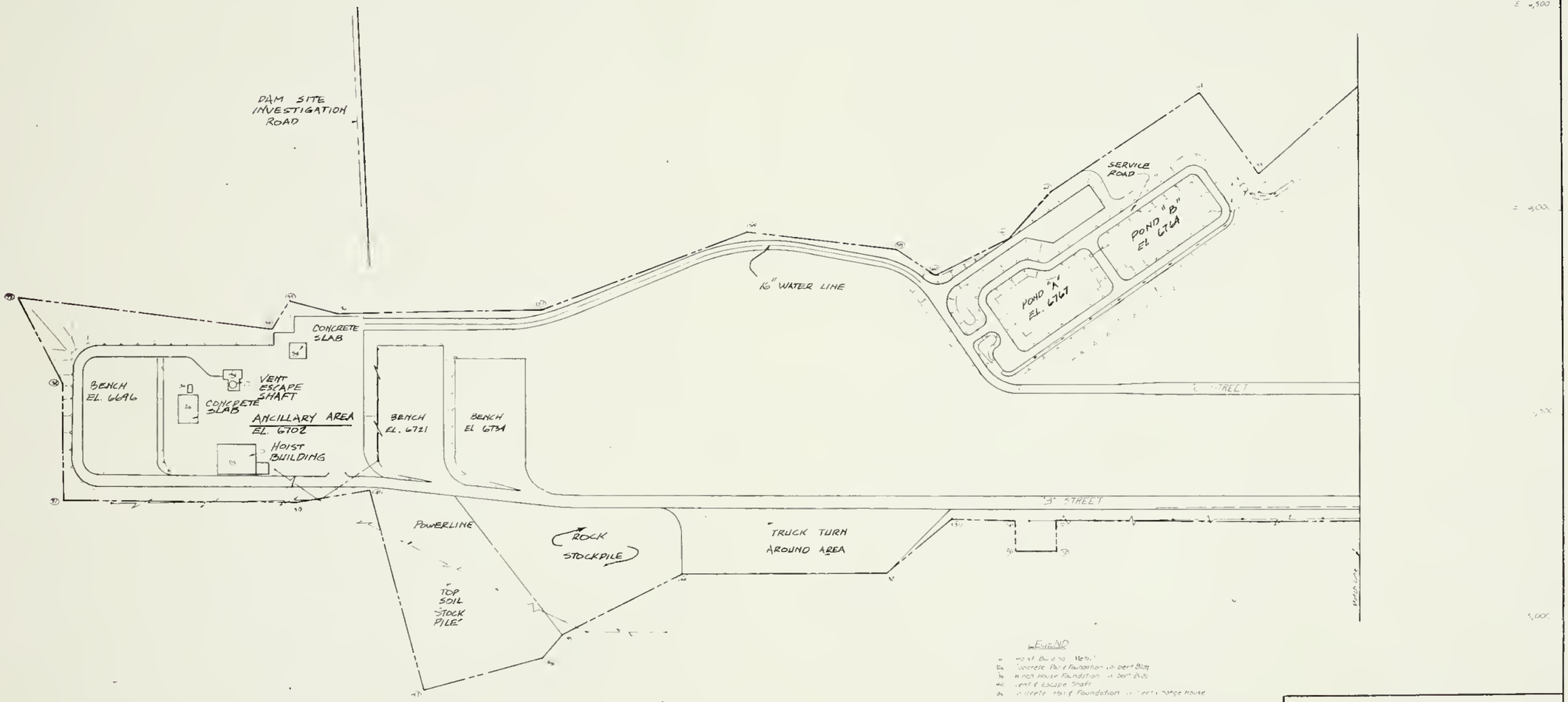


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FIGURE 4-3
LOCATION OF FACILITIES
IN THE V/E SHAFT AREA

4.2.9 Water Supply

A well was drilled near the Piceance Creek to supply construction water. The well, tank, pumps and piping were completed in September. Prior to completion of the well, water was taken from the Piceance Creek as permits allowed.

Potable water supply is discussed in Section 7.4.

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5.0 PROCESSING

Construction of processing facilities will take place upon completion of shaft sinking and initial mine development.

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6.0 OVERBURDEN AND SHALE HANDLING

6.1 Overburden Disposal or Storage

Approximately 21,000 cubic yards of rock overburden were removed from the Service Shaft, Production Shaft, V/E Shaft and Air Shaft. This material was hauled by truck and loader to the soil disposal area east of the mine support area. See Figure 4-1. Chemical palliatives were applied to control dust.

6.2 Raw Shale Disposal

No raw shale was mined or disposed. Methodology for disposal will be as outlined in the Modification to the DDP.

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7.0 ACCESS & SERVICE - CONSTRUCTION ACTIVITIES

7.1 Main Access Road

The main access road has been completed with the exception of signs. The road was started in March and was paved in August. Guardrails were installed by the end of November.

7.2 Pipeline Construction

Construction of a natural-gas pipeline to the temporary generators used for shaft sinking began during December. The pipeline parallels the main access road and terminates at the north end of the Mine Support Area.

7.3 Fuel Supply and Storage

Temporary fuel and water storage tanks have been installed and are being connected to the pipelines. Facilities for the storage and dispersal of diesel fuel and gasoline are being installed.

7.4 Potable Water

Potable water was trucked to the site from Rifle during 1978. On-Tract water wells and facilities will be provided in the future to supply potable water needs.

7.5 Communications

Occidental Oil Shale, Inc. increased the capacity of its microwave communications between Grand Junction and Tract C-b in 1978. The system was enlarged from six channels to eleven channels to facilitate better telephone communication and data transmission capacity.

In addition, a telephone switchboard (PBX) was installed at the Tract in late 1978. Interoffice communication through dial intercom is now possible without accessing the Grand Junction switchboard.

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8.0 ENVIRONMENTAL PROTECTION

8.1 Air Pollution Control

8.1.1 Activities in 1978 Potentially Affecting Air Quality

Principal activities in 1978 with the potential to affect air quality included the collaring of both the Production and Service Shafts, preparation of the V/E Shaft Area, truck transport along haul roads, personnel and truck transport along the main access road, installation of temporary power generators, and construction and operation of the concrete batch plant.

8.1.2 Lease Requirements, Applicable Laws and Regulations and Control Plans

These were detailed in Section VA.2 of the Detailed Development Plan (DDP). Both Federal and State air quality regulations as presented in the DDP have been subject to periodic update and revisions; such revisions are not to be reported here.

Comparisons with ambient air quality standards are made in Volume 2 of this annual report.

C-b has obtained a Prevention-of-Significant-Deterioration (PSD) Permit for the Ancillary Phase from the EPA on December 15, 1977. In the summer of 1977 an Air Quality Control Plan was prepared for the AOSO as supplemental material to the DDP; this control plan was also part of the submittal package for the PSD permit. Air diffusion modelling of the Ancillary Phase was part of the control plan to demonstrate PSD compliance.

8.1.3 Air Pollution Control Activities in 1978

Two air pollution control "systems" are in effect currently at the C-b Tract: baghouses on the concrete plant and applications of water and dust palliatives on unpaved roads. Emissions from temporary power generators are uncontrolled; controls are not required.

8.1.3.1 Concrete Batch Plant Baghouses

Air pollution control equipment operating at C-b consists of four baghouses installed on the concrete batch plant. Baghouses 1 and 2 are both rated at 658 ACFM and can accept dust loading of 45.12 pounds per hour. Each unit contains 16 dacron bags with a diameter of 0.57 feet. The air-to-cloth ratio is 3.5 CFM:1 ft^2. The systems are equipped with an automatic shaker and are rated with an overall efficiency of 99.5% dust removal.

Baghouses 3 and 4 are rated at 303 ACFM and can accept dust loading of 38.9 pounds per hour. Each unit contains 16 dacron bags with a diameter of 0.57 feet. The air cloth ratio is 1.6 CFM:1 ft^2. The baghouses are equipped with an automatic shaker and are rated with an overall efficiency of 99.5% dust removal.

Baghouses 1 and 2 provide the venting of the six cement silos. Baghouses 3 and 4 collect particulates generated by the batch bin. This facility is permitted in its entirety by Permit Number C-11931(1-5) issued by the Colorado Air Pollution Control Division.

8.1.3.2 Fugitive Dust

The C-b Project obtained a Fugitive Dust Permit (C-11,454(FD)) from the Colorado Air Pollution Control Division on August 30, 1977. Pursuant to this permit, C-b was required to pave the major access road to the Tract. This was accomplished in August of 1978. PSD and Fugitive Dust permits require dust control on haul roads by regular applications of water and dust palliatives. The PSD permit requires quarterly reports to the EPA regarding both total water used and the amount and type of dust palliative applied. Water has been applied to the haul roads, on an as-needed basis. Dust palliatives have been applied during 1978 as follows:

MONTH	AMOUNT
May	2720 gal.
June	3000 gal.
July	0
August	5500 gal.

The dust palliative applied was a chemical called "Coherex." It is a water emulsion of petroleum resins and oil that is diluted with water. The ratio of Coherex to water is dependent on usage, moisture content, and texture of material to be stabilized. Heavy use areas (i.e., parking lot north of offices) received a 4:1 (water to Coherex) application. All other areas were sprayed using a 7:1 dilution rate. These areas included the road to the V/E Shaft Area and the area itself, road to the Explosive Area and the area itself, road to Station 024, White and Sons parking lot and around the shaft areas. Where no traffic is expected (disposal area) a 20:1 rate was used.

Fugitive dust arising from construction of surface facilities at the V/E Shaft Area has been monitored from air quality site 042 in 1978. During this time period, no violations of State or Federal ambient standards were noted at this site from construction.

As another control measure to reduce vehicular traffic, a busing system was instituted in 1978; this service currently makes 300 trips per month (total to Rifle plus Meeker); it is estimated that 60-70% of Tract personnel ride the buses.

8.1.3.3 Temporary Power

Four temporary power generators of 1360 net BHP each were permitted on December 26, 1978 by the Air Pollution Control Division for burning diesel fuel (later modified in 1979 for natural gas) for which the following conditions applied for each of the four units:

1) Visible emissions shall not exceed 20% opacity;
2) Particulate emissions shall not exceed 0.25 lbs. per million BTU heat input; and
3) SO_2 emissions shall not exceed 2 tons per day.

Per the permit these emissions are uncontrolled.

8.2 Water Pollution Control

8.2.1 Activities in 1978 Potentially Affecting Water Quality

Principal activities in 1978 with the potential to affect water quality included collaring of both the Production and Service Shafts, preparation of the V/E Shaft Area, construction of ponds, miscellaneous land surface modifications associated with construction, and transport along unpaved roads.

8.2.2 Lease Requirements, Applicable Laws and Regulations and Control Plans

These were detailed in Section VB.2 of the Detailed Development Plan. Revisions to Federal and State laws and regulations are not reported here.

In 1978 Piceance Creek had not been classified with regard to use.

Although C-b possessed a valid National Pollutant Discharge Elimination System (NPDES) permit in 1978, there were no discharges.

8.2.3 Water Pollution Control Activities in 1978

Inasmuch as there was no discharge, no reporting to the State under the NPDES was required other than the statement, "No Discharge."

During the past year sedimentation basins were designed (Colorado Highway Dept. Specifications) and constructed for each drainage area which has been disturbed. Slash was piled down-slope to filter sedimentation in the same areas. Erosion control measures related to these activities are discussed in Section 8.9, Erosion Control and Rehabilitation. Dust palliative was applied to disturbed areas and roads to reduce air and water pollution. Streams, springs, seeps, and wells were monitored in order to detect changes in water quality parameters.

8.3 Spill Contingency

No shale oil or other byproducts were produced or stored on tract. Spills were limited to small quantities of fuel and lubricants. Storage locations have proper diking consistent with the amount of stored material. An on-site disposal tank for storage of used oil has been provided to areas utilized by subcontractors.

The spill response team for 1978 was:

Spill Response Coordinator	- W. W. Shriver
Cleanup Coordinator	- G. G. Brun
Government Liaison Coordinator	- J. J. Hill
Public Relations Coordinator	- M. D. Talbert
Legal Coordinator	- D. R. Hale
Environmental Protection Coordinator	- E. B. Baker
Procurement and Logistics Coordinator	- W. Beene
Document Coordinator	- L. C. Bender
Accounting Coordinator	- G. A. McClelland
Training Coordinator	- C. E. DeLoach

The Spill Prevention, Control and Contingency Plan as is contained in the DDP is still valid and the basis for current activities.

8.4 Fire Control

The fire control system presently utilizes chemical hand-held-and-wheeled fire extinguishers. All buildings, including the hoist house, are so equipped. A gaseous extinguishent (Halon 1301) system has been designed for the Ventilation and Escape Shaft hoist house and will be installed during 1979.

Rubber-tired water-tanker trucks are available for use in extinguishing brush fires that might develop on site.

8.5 Waste Disposal

Wastes were disposed in the following manner in 1978:

a. Construction sewage wastes during 1978 were hauled from C-b to an off-tract sewage plant by a commercial trucking firm. Office-facility wastes were handled by an on-site sewage system.

b. Slash from cleared construction areas was placed down-slope from disturbed areas and used for erosion control. Firewood was stacked in accessible locations for distribution to the public.

c. Construction waste materials and garbage were shipped to an off-tract disposal site by a commercial trucking firm.

d. Drain oil and grease from the construction equipment were stored on tract and transferred off site by a waste-petroleum dealer.

8.6 Historic, Scientific and Aesthetic Values Protection

As an initial part of the lessee's plans to protect these assets, archaeological and scenic-value studies have been undertaken on the tract and surrounding area. During construction no significant findings were noted.

Where possible, existing vegetation was saved; and stockpiles were contoured and seeded to blend with surrounding habitat.

8.7 Noise Control

Occupational noise control for employee protection is accomplished where feasible by equipment design. When this approach is not feasible, or when engineering design does not reduce noise levels below the maximum allowable limit, all exposed persons are required to wear ear protection.

Monitoring of environmental noise and its compliance is discussed in Volume 2.

8.8 Fish and Wildlife Protection

8.8.1 Objectives

This plan has been developed to provide procedures to avoid or minimize adverse effects on fish and wildlife caused by the development and operation of oil shale facilities on tract C-b. This habitat management plan uses the baseline environmental data as a frame of reference. It delineates habitat losses that may occur and mitigation efforts needed either to replace in-kind or to improve alternative habitat for selected species of animals. The plan is to be used both for staff planning and for coordination with government agencies. This plan is a dynamic document, updated and revised as new management direction and information become available. Because this plan was developed in cooperation with the DOW, BLM and AOSO, any revisions will be developed among the original cooperators and in coordination with the Regional Piceance Basin Habitat Management Plan, with final approval of the AOSO.

8.8.2 Estimated Access-Road Effects

It was previously estimated that the main access road might impede deer movement through the pinyon-juniper vegetation type north of the tract and that a major ecosystem impact might result from deer/vehicle collisions. Neither has proven to be the case. Deer still cross the road frequently; no deer have been hit by vehicles along the main access from Piceance Creek Road to Tract C-b.

8.8.3 Mitigative Actions Taken in 1978

Approximately 320 acres on Tract C-b were fertilized in April to offset the 160 acres disturbed by construction activities. This was a short-term project to improve the habitat for wildlife and livestock over the next several years. A total of 16 tons of fertilizer (eight tons of ammonia nitrate, 34-0-0; and eight tons of nitrogen phosphorus, 30-20-0) were applied on 320 acres of chained pinyon-juniper woodland. The fertilizer was applied at the rate of 100 lbs. per acre using a helicopter equipped with a broadcast bucket. Two 80-acre plots were fertilized with ammonia nitrate and the other two areas with nitrogen-phosphorus. Range cages and utilization and deer-day-use transects were established in each area with control transects outside each.

Two water impoundments (tanks) were installed on tract to provide water for livestock and wildlife. The tanks were made from two tractor tires with one sidewall removed and the other sealed. Their capacity is approximately 400 gallons each. Ramps for birds and small mammals were installed. The tanks are filled by a water truck.

To help reduce the Piceance Creek wildlife roadkill, C-b initiated the following actions:

1. Busing from Meeker and Rifle to Tract C-b was initiated;

2. Road signs were installed to make the public aware of deer-kill problems;

3. Literature was distributed and meetings held to inform employees about the roadkill problem and accident prevention procedures.

4. Roadkill and deer movement data were collected to better understand the problems and define additional preventative actions.

Small branches of newly-cut trees were distributed on the ground to serve as deer browse rather than chipping.

8.8.4 Planned Mitigation for 1979

Several of the sagebrush draws north of Piceance Creek Highway will be brush beat and reseeded to provide grass and browse for wildlife and livestock to remove deer from proximity of the road. Check dams will be built in the above draws to provide water for the wildlife and livestock in the spring and fall.

8.9 Erosion Control and Rehabilitation

8.9.1 Introduction

The general summary of expected activities, primary goals, and methods as outlined in the DDP and Modifications thereto are still relevant as previously presented. A summary of lease requirements, applicable laws and regulations are also discussed therein.

8.9.2 Recent Developments

The erosion control plan has been further defined in a report by Heley Engineering (1978). In this report, the runoff potential of the disturbed areas around the mine support area, V/E Shaft area, and material storage sites was determined. To control the sediment load, a total of six sediment basins were built along with a number of lesser control measures, such as slash windrows in the downslope direction, straw barriers, and rock check dams.

Disturbed areas were permanently or temporarily seeded, depending on future use.

In general, topsoil stockpiles and abandoned access right-of-ways were seeded permanently. Slopes of the support, V/E Shaft area and office areas were temporarily seeded; in addition, a dust palliative (Coherex) was applied. The level surfaces of these areas were also treated with Coherex. Dust palliative and/or water was applied to roads as needed.

Recently a more detailed reclamation plan was required by the Colorado Mined Land Reclamation Board. In March of 1979, this plan was approved. The following is a brief outline of this plan:

1. Intent or goal definition.

2. Statement of proposed post-mining use.

3. Timing of the plan.

4. Grading and topsoil specifications.

5. Water management plan.

6. Mitigation plans and estimated effects on wildlife.

7. Revegetation and stabilization plans for affected areas without raw shale and areas with raw shale. Temporary revegetation or stabilization was also outlined for areas used for continued operations.

8. A species list for the two major aspects and one for temporary seeded areas.

9. An activity schedule for 1978. Table 8-1 presents this schedule for 1979. Figure 4-1 shows locations of most of these activities.

Inasmuch as this report to the Mined Land Reclamation Board was not completed in 1978, more details will be presented in the next Annual Report.

8.10 Health and Safety Control

8.10.1 Health and Safety Program

All levels of C-b management have made a complete commitment to employee protection. Top management conducts regular meetings during which health and safety matters are subjects of discussion. Various contractors on-site conduct regular safety meetings for their employees with the active participation of the C-b Safety Department. New employees are indoctrinated with on-site safety rules. Considerable progress has been made in the development of a training plan in conformance with Mine Safety and Health (MSHA) regulations. First-aid training for C-b and contractor employees has been completed as required.

Presently on-site, C-b has a Safety and Security Supervisor and a Senior Safety Inspector. Two major contractors also have full-time safety personnel.

TABLE 8-1

RECLAMATION ACTIVITY SCHEDULE (UPDATE 1979)

AFFECTED AREAS	(1978=1) DISTURBANCE TIMETABLE	RECLAMATION PHASE-YEARS	ACREAGE
Existing Guard House	1	61	1
Traffic Control Station & Future Guard House Area	1	61	3
Access Road	1	61	22
Mine Support & V/E Shaft Area (Administration, stockpiled rock areas, batch plant, sedimentation impoundments, water treatment)	1	61	101
Stockpiled Rock - V/E Shaft Area	2	61	3
Stockpiled Soil - Support Area	1	1	5
Stockpiled Soil - V/E Shaft Area	1	2	1
East No Name Dam - Investigation	1	61	1
East No Name Dam - Potential Site	3	61	40
Explosives Area	1	61	1
Process Area	3	61	20
Temporary Soil Stockpile	2	61	3
Product Storage Area	3	61	9
Water Discharge & Land Application	2	61	40
Disposal Embankment			
Initial Berm into East No Name Gulch	1	4	1
Fill into East No Name	2	4	10
Berm across Cottonwood Gulch	3- 4	5- 6	42
	5- 6	6- 7	102
Advancing Face in Cottonwood & Sorghum and Starter Berms	7-10	8-11	146
	11-15	12-16	113
	16-29	17-30	339
Advancing Face across Sorghum Gulch	30-35	31-36	169
	36-40	37-41	271
	41-50	42-51	231
	51-60	52-62	212
		TOTAL----	1886 acres

Around-the-clock emergency medical service is provided by two paramedics and six EMT's. A modern, fully equipped ambulance is available on-site for emergency medical evacuation. A comprehensive medical surveillance program has been established with the assistance and through the cooperation of local physicians who also provide ongoing specialized training for emergency medical personnel. Complete physical examinations, with periodic re-examination, are being conducted for all Occidental employees.

During 1978, there was only one MSHA inspection which resulted in two minor citations. Corrections were made and the citations abated promptly. The Colorado Division of Mines conducted eight inspections, resulting in 18 citations. All citations were abated immediately.

Accident frequency and severity ratios are discussed in detail in Volume 2. It is to be noted, however, that the injury rate and severity measures of 1.35 and 3.16 respectively compare very favorably with the 1978 national average for underground mines of 16.32 and 23 respectively.

8.10.2 Possible Health Hazards

8.10.2.1 Dust

Dust is controlled on unpaved sections of roadways by the application of a dust suppressant. Dust is controlled during rock drilling operations by the use of water. Although there have been no surveys conducted yet to determine full-shift employee-exposure to dust, it is not anticipated that problems exist in this area. Respirators are provided for employee use when assigned to dusty areas. An ongoing study is being conducted with the assistance of the Department of Energy at another location to determine possible harmful effects of oil shale dust exposure.

8.10.2.2 Explosives Handling and Storage

Explosives for mining and surface-construction use are stored in surface magazines which meet the criteria of the appropriate regulatory agencies. Explosives-handling and transportation from magazine to the work site are conducted only by experienced, trained workers.

8.10.2.3 Fumes

Hand-held detection instruments will be used for sampling the atmosphere at the shaft bottoms for the presence of methane and hydrogen sulfide. Samples will be taken at shift start-up and after each blast. If either gas is detected, sampling frequency will be increased and appropriate actions taken as necessary.

8.11 Permit Status

A C-b permit status report including permits obtained to date (19 of them) is presented on Table 8-2.

TABLE 8-2

Compilation Date: February 1, 1979

C-b PERMIT STATUS REPORT

PERMITS OBTAINED TO DATE

No.	Permit Title	Purpose	Agency	Permit No.	Date Submitted	Date Approved	Expires	Remarks
1	Notice of Prospecting	To allow site preparation and shaft sinking Activities	M.L.R.B.		3/77	Not Required		Bond being prepared to cover 100+ acres during Ancillary Program.
2	Conditional Use	Temporary Zoning "Mineral Research Site"	Rio Blanco Co.		3/1/77	4/77	3/79	Allows us to do site preparation.
3	SPCCP	Spill Prevention & Countermeasure Control Plan	E.P.A.		2/76	Not Required		
4	FCC License	Microwave Communications	F.C.C.	(15562-IP-67x) (15563-IP-67x) (15564-IP-67x)	5/31/77	8/2/77	8/2/82	Stations located at Grand Mesa, Monument Peak & C-b Site.
5	Monument Peak Right-of-Way	Microwave Communications	B.L.M.	C-25677	7/31/77	10/20/77	Ind.	
6	Road Right-of-Way	Construct Access Road	B.L.M.	C-15827RW	9/13/77	1/24/78	Good for Life of Tract	
7	Federal Stream Crossing	Construct culvert across Piceance Creek	U.S.A.C.E.		10/13/77	12/20/77		Work Completed
8	Fugitive Dust	Control dugitive dust during site preparation and shaft sinking.	A.P.C.D.	C-11,454(FD)	6/20/77	8/29/77	5/5/80	
9	Piceance Creek Water Right	Construction water	Water Court		7/26/77	None Required		
10	NPDES	To discharge waters into Piceance Creek in upset	W.Q.C.D.	CO-0033961	3/15/77	10/21/77	12/31/78	Effective 30 days after receipt by applicant. Received 10/24/77.
11	Certificate of Non-pollution	For Stream Crossing	W.Q.C.D.		12/21/77	1/9/78		Work Completed

TABLE 8-2 (Cont'd)

Compilation Date: February 1, 1979

C-b PERMIT STATUS REPORT

PERMITS OBTAINED TO DATE

No.	Permit Title	Purpose	Agency	Permit No.	Date Submitted	Date Approved	Expires	Remarks
12	P.S.D.	Prevention of Significant Deterioration of background air before lighting any retort.	E.P.A.		10/17/77	12/15/77	At end of Ancillary Phase.	
13	Mined Land Reclamation Plan	Plan to Surface Disturbance Reclamation	M.L.R.B.		11/7/77	3/23/78		Allows 10 Retorts, 711 Acres
14	Temporary Use	Asphalt Batch Plant	Rio Blanco Co.		6/2/78	6/5/78		
15	Emission Permit	Batch Plant	APCD	C11931-165	5/18/78	6/23/78		
16	Well Permit	Construction Water from Piceance Creek	State Eng.					
17	Site Approval	Sewage Plant	WQCD	2852		8/3/78		Construction must commence by Aug. 1, 1979 or this expires.
18	Piceance Creek C-b Pipeline #1	Transport water from Piceance Creek to C-b	Water Court	W-3441	7/27/77	2/28/78		Diligence must be filed every four years after February 1978.
19	FAA Notice of Proposed Construction	Structures over 200 feet	FAA		8/18/78	None Required		

Note: Building permits are not included

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9.0 SOCIO-ECONOMIC ACTIVITIES

9.1 Workforce

In February 1979, the C-b on-site workforce was 253. Approximately 230 of these, or 90 percent of the total, hold construction or temporary jobs; and the remainder are permanent employees. Figure 9-1 indicates that while the actual workforce has been running somewhat above the workforce projections throughout 1978, it is now slightly under projected levels due to a lag in activity between head-frame construction and resumption of shaft sinking. In 1979, the workforce is expected to continue its build-up to the projected level of approximately 600 by year-end.

9.2 Population Build-Up

The population profile associated with activities on the C-b shale oil tract is estimated based on the results of C-b's 1978 Annual Socio-economic Monitoring Report. These figures show that nearly half (46 percent) of the sample of C-b's workforce are married and living with their families in the oil shale region. With an average family size of 3.5 for these households, and including the remainder of the workforce as single status, current C-b-related population is estimated at 543. Around 100 of this total represents school-age children (ages 5-18). Adjusting these findings and applying them to 1979 year-end employment projections, between 1,200 and 1,400 people may be expected to reside in the area. Of these, an estimated 300 will be school-age children new to the area.

9.3 Transportation

Bus transportation for C-b tract employees from Rifle and Meeker to the tract was started April 1, 1978. Transportation is provided, at no charge to the employee, seven days a week, three shifts per day. Through December 1978 approximately thirty thousand (30,000) workers have used this service. The buses used in this service are forty-seven passenger, restroom equipped coaches with reclining seats and footrests. Every effort is made to have as attractive service as possible to ensure utilization of the buses by the workforce.

9.4 Housing

C-b provided front-end capital for construction of 48 apartment units in Meeker and 40 units in Rifle totaling $740,000 and providing for a two-year lease on the units. The company had signed a ten-year lease for development of a 292-pad recreational-vehicle and mobile-home facility in Rifle. The recreational-vehicle portion of the park is operated under a special use permit granted to the park's developer for a five-year period. Paid in advance is $154,500 per year for each year of the lease.

In addition, C-b has paid $135,000 for the construction of ten townhouse units in Rifle also providing for a two-year lease.

9.5 Community Development Guides

The C-b Project has prepared two development guides--one each for Rifle and Meeker. The development guides cover twelve subject areas including history, taxing and planning jurisdictions, population, community economics, land use, traffic and transportation, housing, education, health, parks and recreation, public services and the comprehensive planning process.

9.6 Mitigation Task Force Support

C-b is currently providing their own representation as well as the support services of its consultants to the task forces in Rifle and in Garfield and Rio Blanco Counties. The services include provision for updated information through attendance at advisory and core group meetings of the task forces and general funding information and assistance (e.g., the consultants were instrumental in a presentation by the State Department of Local Affairs of their Fiscal Capacity and Evaluation System Model). C-b also provides assistance with special requests such as work now underway to develop a plan for Rifle's hospital.

9.7 Worker Programs

C-b recently completed a report on social impacts relating to boom areas focusing on the oil shale area. The report was prepared in response to citizen concern about past and future problems such as alcoholism, child abuse and spouse abuse.

9.8 Monitoring

In conjunction with the worker programs task, C-b has funded a program to monitor the workforce and changes in Meeker and Rifle. Quarterly and yearly reports are being prepared. In the workforce area the reports cover: housing, age, marital status and family size and recreational activities. Regarding the communities, the reports cover housing and land use, law enforcement, schools, hospitals and health care and economic indicators.

9.9 Training

C-b has created a training department and hired a director. The company has initiated a training study detailing how such a program should be conducted.

Follow-up work to this report involves evaluation of the training program and assessment of the location and availability of a labor pool to prepare for workforce needs.

9.10 Community Donations

Requests are occasionally made for donations from C-b to the local communities. The Project has responded in many instances including contributions

to the following: Rifle Junior Soccer League, Rifle 4-H Program, a new building for the Silt-Newcastle Fire District, West Garfield County Youth Organization, a new roof for the Rifle Community Center, Meeker Golf Course, Rio Blanco County 4-H Program and the area Council on Aging.

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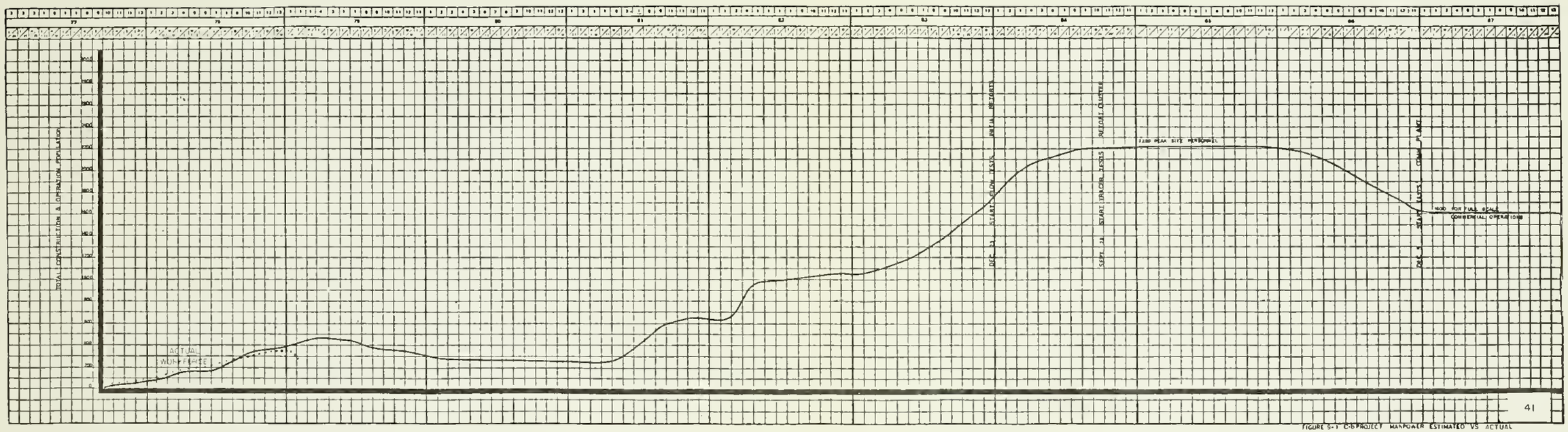
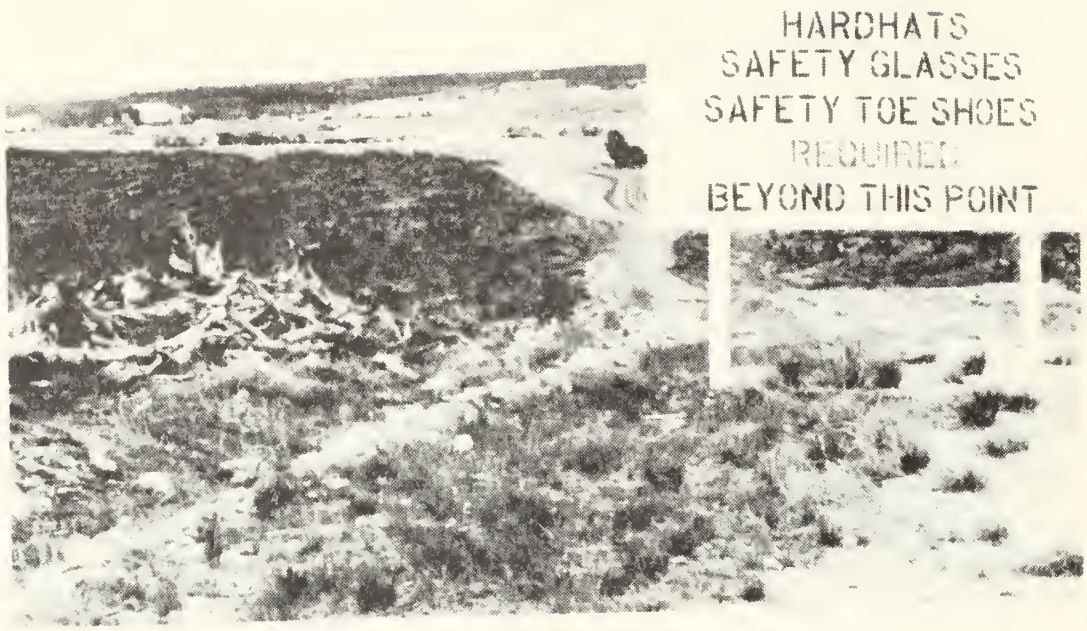


FIGURE 5-1 C-B PROJECT MANPOWER ESTIMATED VS ACTUAL
REVISED 6-1-78

10.0 SITE PHOTOGRAPHS

These photographs support Chapter 4, DEVELOPMENT ACTIVITIES, regarding both site preparation and site construction.

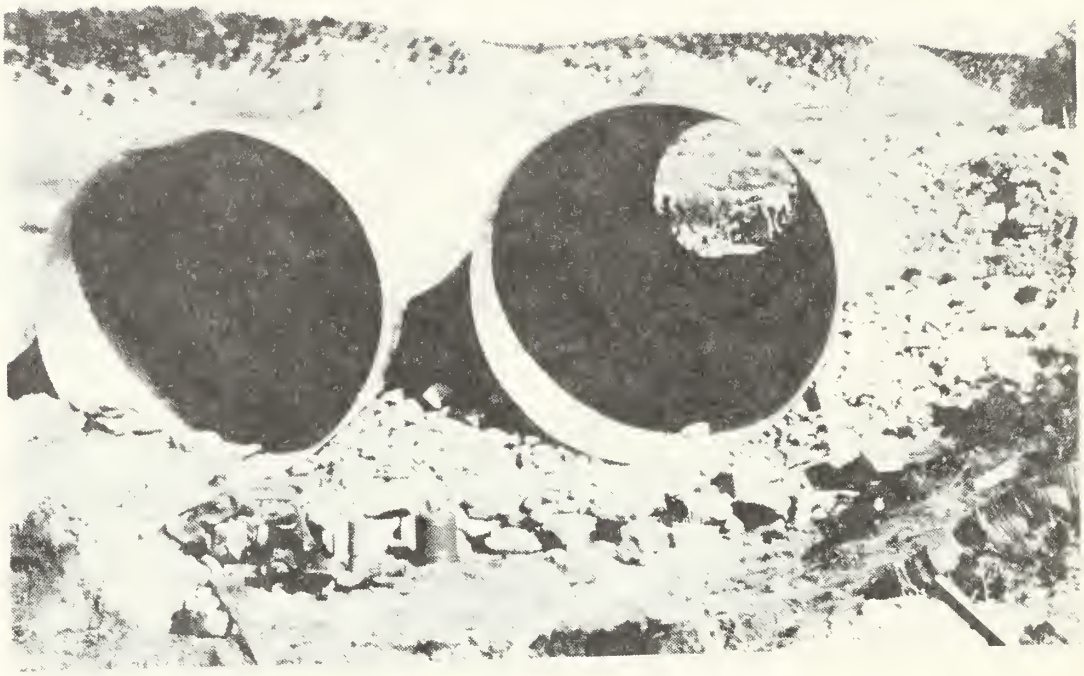


Equipment lined up near the Mine Support Area

Earthwork - Cut-and-fill activities in the Mine Support Area

Earthwork - finishing touches

New cut for the main access road showing a bus on the old road

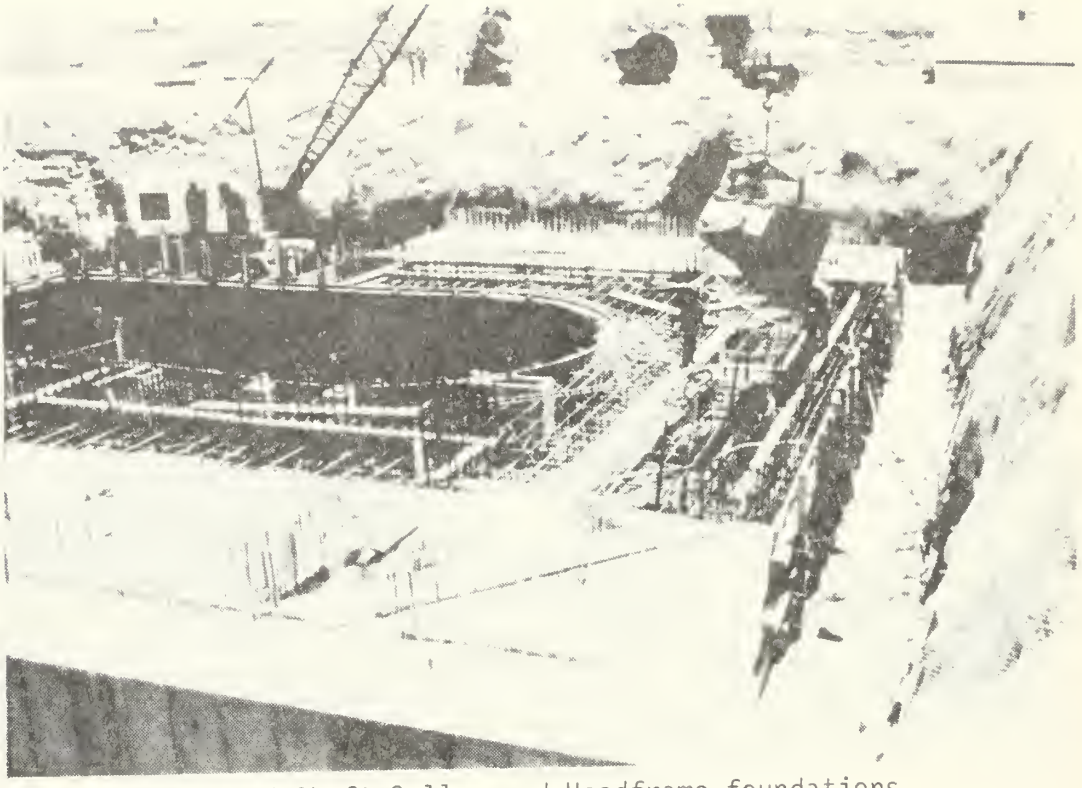


Culverts installed on Piceance Creek for the 100-year flood

Final touches on the road surface

Shaft collar and foundation excavation in the Mine Support Area and erection of temporary Maintenance Building

Construction progress in the Mine Support Area

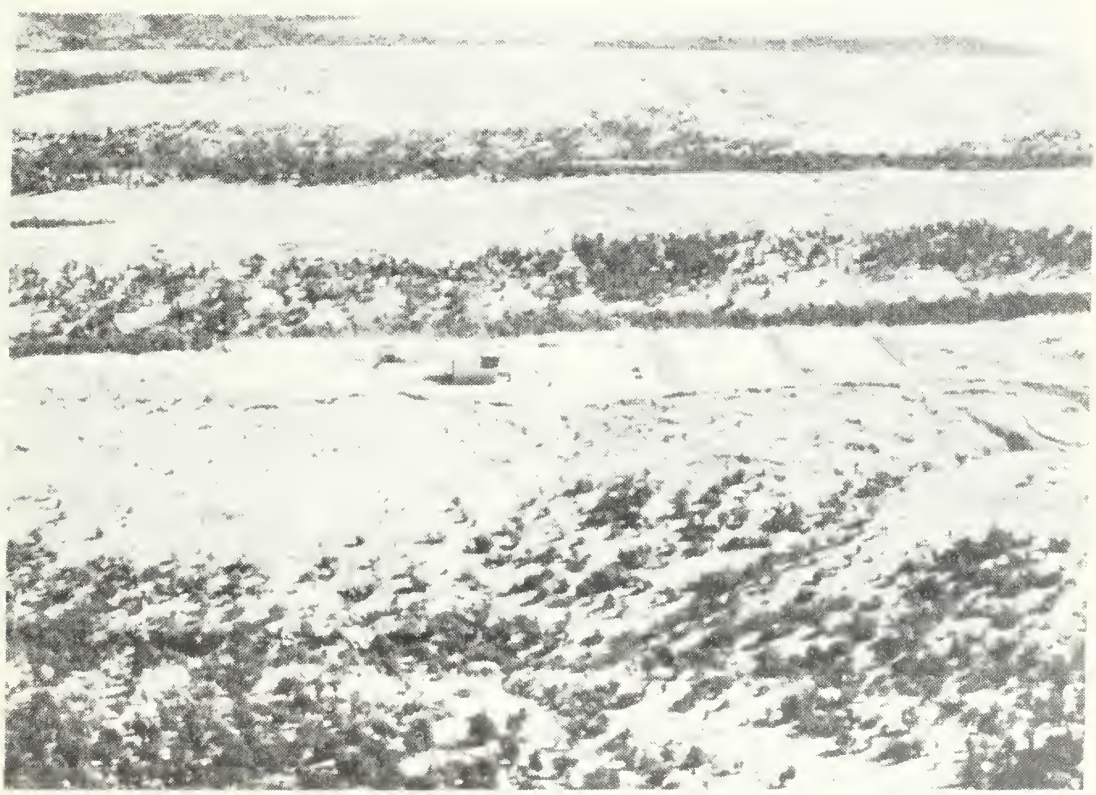


Completed Shaft Collar and Headframe foundations

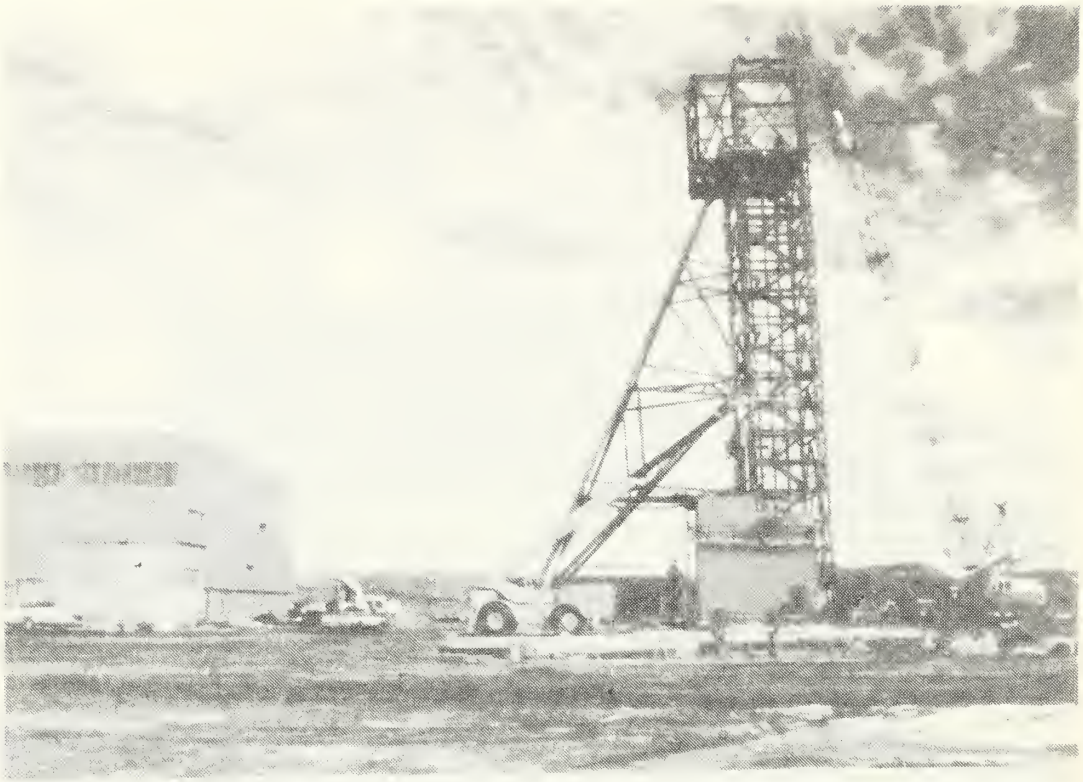
Concrete Batch Plant nearing completion

Operational Concrete Batch Plant

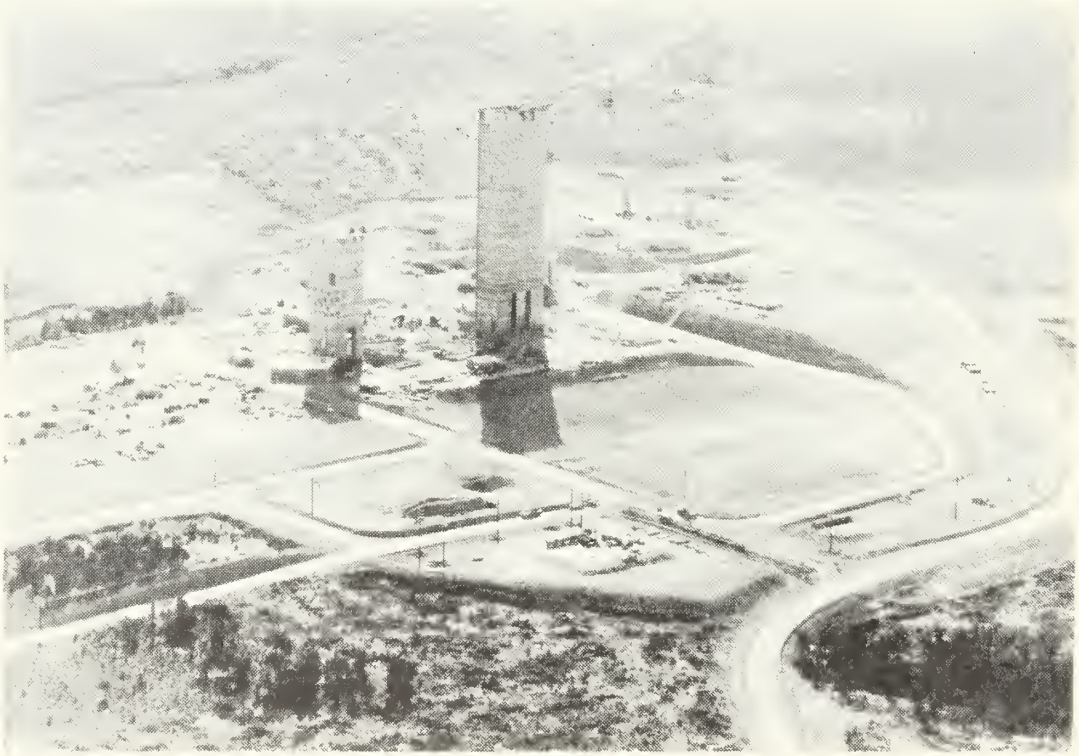
Installation of interior steel begins in the Production Shaft



Ventilation/Escape Shaft - start of Headframe and Hoist-house construction



Construction activities nearing completion on Ventilation/Escape Surface Facilities



Headframes tower above countryside

Aerial view of C-b site construction areas

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Part 2 - Environmental Monitoring Summary

11.0 INTRODUCTION TO PART 2

11.1 Scope

The Environmental Baseline Period for Oil Shale Tract C-b covered the period from November 1, 1974, to October 31, 1976. Results have been reported in 9 Quarterly Data Reports, 8 Quarterly Summary Reports, C-b Annual Summary and Trends Report (1976), and a 5-volume Environmental Baseline Program Final Report (1977), all submitted to the Area Oil Shale Supervisor.

From November 1, 1976 through August 31, 1977, the C-b Tract was under a period of suspension of the Federal Oil Shale Lease. This period was known as the Interim Monitoring Phase. Environmental data for this time period were submitted to the Area Oil Shale Office (AOSO) on October 14, 1977 (Interim Monitoring Report #1). The Interim Monitoring Period was later extended by the AOSO to cover the period from September 1, 1977 through March 31, 1978. Data for this time period were submitted to the AOSO on May 15, 1978 (Interim Monitoring Report #2). The Development Monitoring Program was initiated in April 1978. Final approval of the Development Monitoring Plan by the AOSO is expected in the near future. Data for the time period from April 1978 through September 1978 were submitted on January 15, 1979 to the AOSO. Subsequent semi-annual data reports are scheduled for delivery every January 15 and July 15.

This annual report contains the first environmental analysis of data for Oil Shale Tract C-b since the final report of the Environmental Baseline Program was published in 1977.

The 1978 C-b Annual Report, Volume 2, Environmental Analysis, presents analyses in all of the broad environmental areas identified in the Development Monitoring Program for data collected since November 1976. Because there is always a data-lag and reduction problem, analyses for some studies are based on data only through September 1978. The report is not as detailed or comprehensive as the 5-volume Environmental Baseline Program, Final Report (1977). It need not be. The Interim Monitoring and Development Monitoring Programs have been reduced and changed from the Environmental Baseline Monitoring Program in many areas. Therefore, emphasis is now placed on key indicators of environmental quality and/or change which are evaluated in this report.

11.2 Purpose

The purpose of this report is to fulfill the requirement of the lease to provide the Area Oil Shale Supervisor's Office with an annual report of environmental analyses. The Development Monitoring Plan states the following objectives with respect to environmental monitoring:

> The purposes or objectives of environmental monitoring as defined in Section 1 (C) of the Stipulations are to provide: 1) a record of changes from conditions existing prior to development operations,

as established by the collection of baseline data; 2) a continuing check on compliance with the provisions of the Lease and Stipulations, and all applicable Federal, State and local environmental-protection and pollution control requirements; 3) timely notice of detrimental effects and conditions requiring correction; and 4) factual basis for revision or amendment of the Stipulations.

Volume 2 documents the analyses and conclusions relative to assessment of potential environmental impacts and trends that may be indicated in the collected data. Since development activities were not started until 1978, much of the data and analyses may be considered as a continuation of environmental baseline and background definition.

12.0 SUMMARY OF ENVIRONMENTAL MONITORING

Environmental monitoring and analyses are continuing on Oil Shale Tract C-b. Development activities commenced within the past year have resulted in increased activity on the Tract in the form of off-road vehicular use, facility construction, shaft sinking, and traffic into and out of the area. All activity has been conducted within strict adherence to environmental, permit, and lease regulations. Environmental impacts, where they exist, have been confined to the immediate area and within limits defined in the Detailed Development Plan.

12.1 Tract Photography

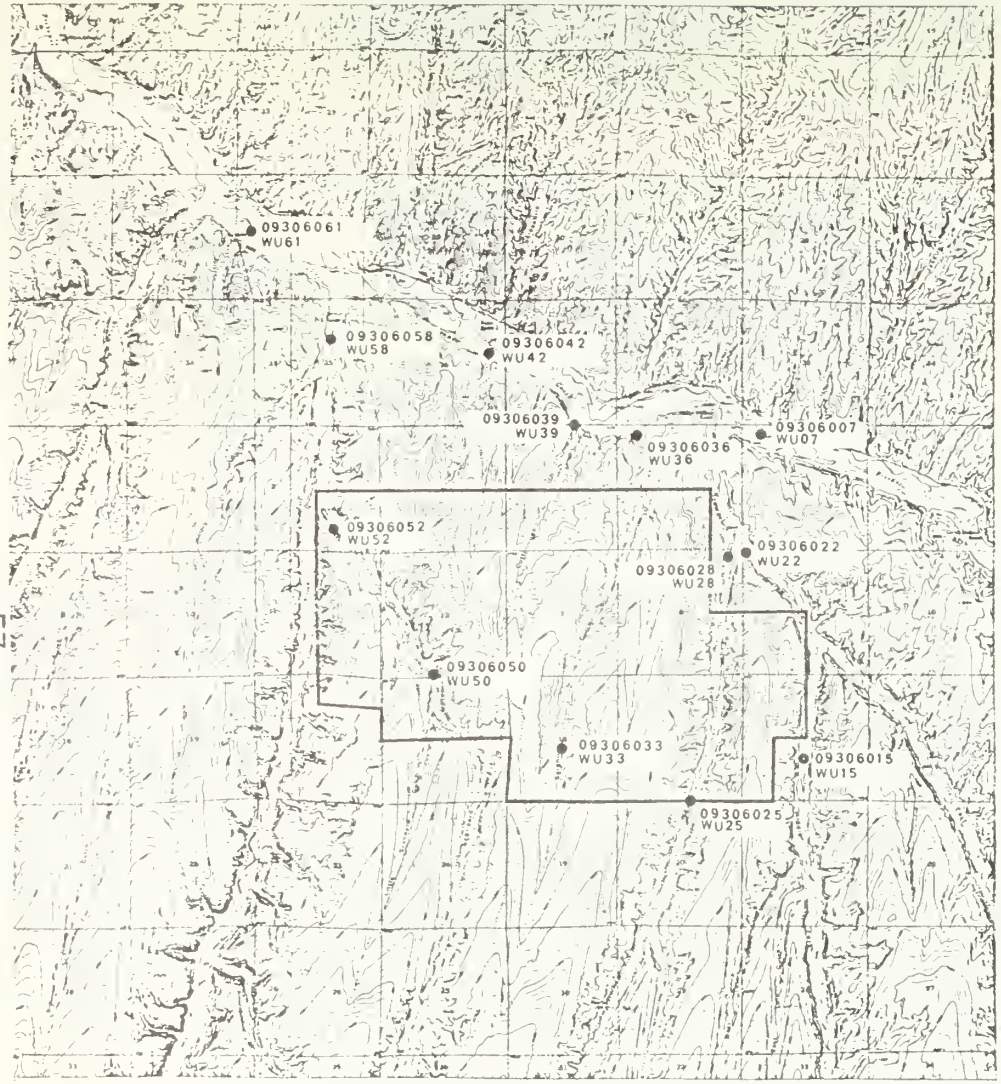
A tract surface and aerial photography program has been initiated to provide permanent records of change and surface disturbance. Sufficient time lapse has not occurred to identify other than purely qualitative effects of wet or dry years on vegetation from the aerial photographs.

12.2 Indicator Variables

The Development Monitoring Program has been brought into sharper focus with the identification of Class 1 indicator variables. These are key environmental variables collected at representative stations in at-least monthly sampling frequency. Time series plots, largely generated by the computer from the data base, are presented in Appendix B for Volume 2. These plots will be maintained and updated monthly (as a goal) to provide visual analyses of trends and interrelationships.

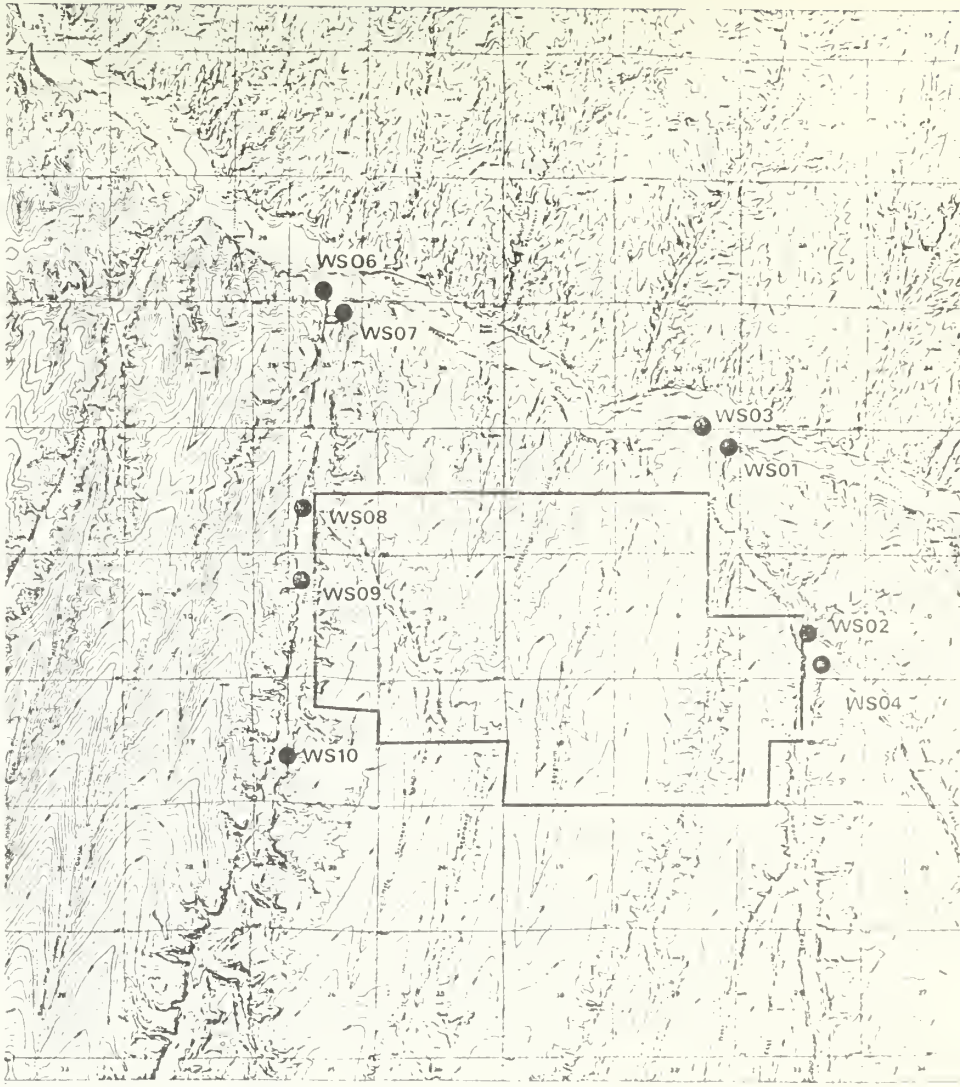
12.3 Hydrology

A development monitoring program has been implemented to provide water quantity and quality data for the purpose of impact evaluation. Presently, streams, springs, seeps, and alluvial and bedrock aquifers are monitored. The program will be expanded to include monitoring of water from shaft-sinking activity impoundments, and shale piles as development proceeds. The monitoring station locations are shown on Figures 12-1, 12-2, 12-3, and 12-4. The present hydrologic monitoring network is conceptually the same as during the baseline period. However, the bedrock aquifer system underlying C-b Tract has been



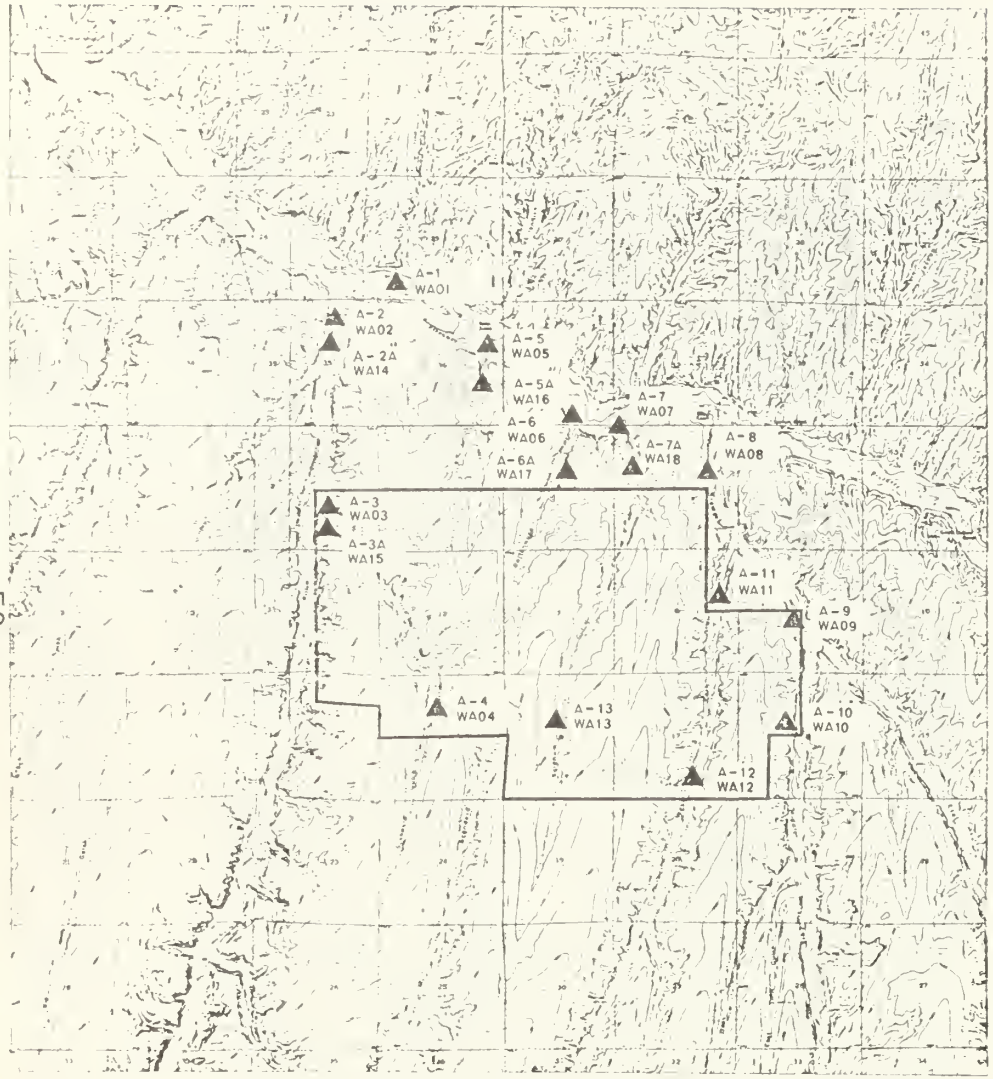
USGS STREAM GAUGING STATION MONITORING NETWORK

FIGURE 12-1



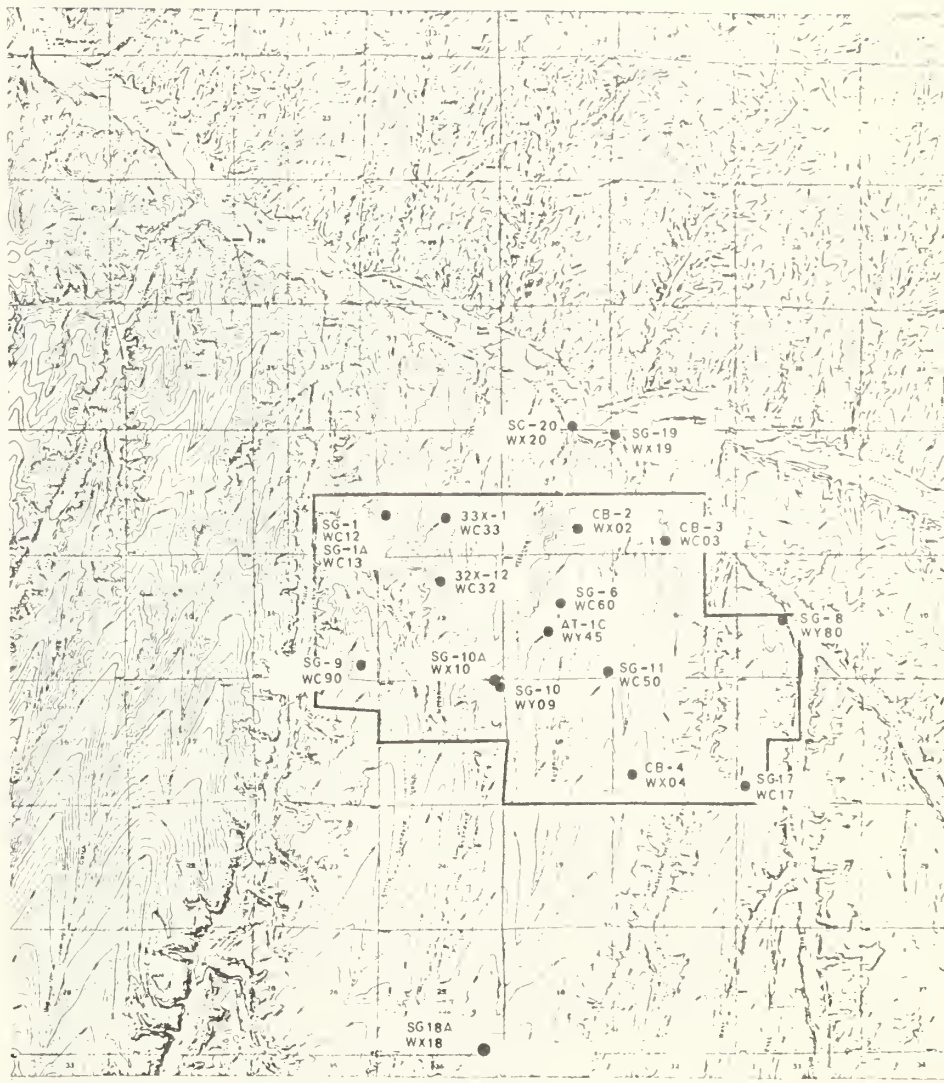
SPRINGS & SEEPS AROUND
Cb TRACT

FIGURE 12-2



ALLUVIAL AQUIFER MONITORING NETWORK WITH PROPOSED NEW ALLUVIAL WELLS
A-2A, A-3A, A-5A, A-6A, A-7A

FIGURE 12-3



DEEP WELL MONITORING NETWORK
C-b TRACT

FIGURE 12-4

redefined. Observation wells were completed in accordance with the concept that the Tract is underlain by two aquifers separated by the Mahogany Zone. Pump spinner tests conducted after the baseline period indicated that highly stratified aquifers and aquitards more accurately characterize the aquifer system.

Baseline studies indicated the mean flow for the reach of Piceance Creek adjacent to the Tract to be approximately 15 cfs. These studies showed the water of Piceance Creek to be hard to very hard with $CaCO_3$ concentrations greater than 300 mg/l. The water was found to be a sodium-calcium-magnesium-bicarbonate-sulfate type.

Analyses of current USGS Gauging Stations surface water quality and quantity data reveal no adverse trends for indicator variables either over time or between station locations. Streamflow records on Piceance Creek above and below the C-b Tract show no change in mean annual flows. One day minimum flow averages may be less than 1 cubic foot per second (cfs). Maximum peak flows recorded since baseline were 520 cfs on July 19, 1977 upstream from the C-b Tract, and 492 cfs on September 3, 1977 downstream from the Tract.

A few isolated statistical trends in water quality parameters (sulfate, pH, and arsenic) were noted for some water quality data obtained from springs and seeps. However, suspected spurious values as well as paucity of data discount the significance of these at this time.

Water quality and level data for selected alluvial wells and indicator variables showed no overall trends with time from baseline. Comparison of parameter mean values between stations showed no significant differences for most comparisons. The notable exception is for specific conductance which showed differences in four of six comparisons. Water level in bedrock wells showed no trends over time.

12.4 Aquatic Ecology

It is useful to relate the previous hydrologic discussion to qualitative aquatic ecological considerations as they pertain to Piceance Creek. Piceance Creek as an ecosystem has been characterized as a "productive, disrupted system existing under marginal physical and chemical conditions," imparting the impression of "marginal, low quality aquatic environment" (Woodling and Kendall (1974)). (Bibliography in Volume 2)

Biological production in Piceance Creek is presently restricted by a combination of natural and man-caused factors. Natural factors limiting biological production are the unstable nature of most of the streambed and irregular discharge. Loose sand, silt and mud comprise much of the substratum. These materials are easily shifted about by currents, particularly those associated with runoff of snowmelt and high intensity thunderstorms. In times of low flow, much of the streambed becomes dewatered, thus exposing biota to possible desiccation.

Land use practices along Piceance Creek intensify the adverse effects of some

natural limiting factors. Cattle grazing has probably reduced the vegetative cover of the watershed and thereby contributed to the irregularities in stream flow. Cattle trample stream banks and willow growth along the streams and thus destroy cover for fishes. Irrigation diversions dewater sections of Piceance Creek and return water probably leaches salts from the fields and increases the load of dissolved solids. Ammonia and nitrogen may be leaching in significant amounts from manure emanating from winter feeding concentration of cattle along Piceance Creek.

The water of Piceance Creek is high in dissolved salts relative to the "average" North American stream; however, the load in Piceance Creek is not unusually great for streams in semi-arid western localities. Low quality-high salinity groundwater from deep aquifers reaches Piceance Creek via springs discharging into it, especially in reaches downstream from Ryan Gulch. Although the salinity of lower Piceance Creek is greater than in upstream reaches, there is no unambiguous evidence that salinity is limiting total biological production.

12.5 Air Quality

With regard to air quality, gaseous constituents measured include sulfur dioxide, hydrogen sulfide, carbon monoxide, ozone, and oxides of nitrogen; total suspended particulates have also been measured.

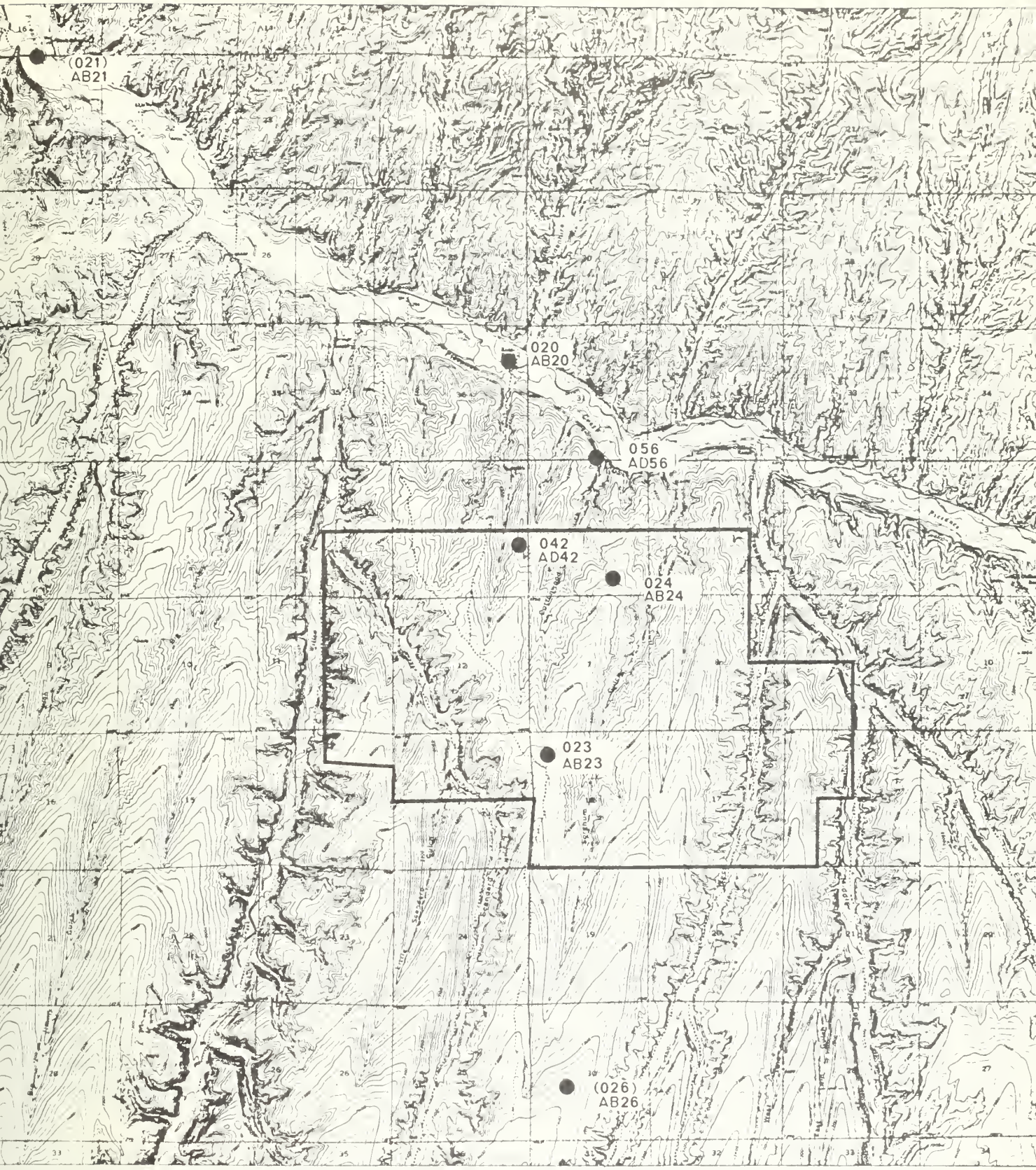
The air quality monitoring network is shown on Figure 12-5; systems-dependent stations are not operational. The air quality trailers making gaseous and particulate measurements and associated meteorology are Stations AB23 and AB20; in addition, particulates and associated meteorological data are also measured at AD42 and AD56. A 60-meter meteorological tower is located at Station AB23, instrumented at three levels. Precipitation measurements are made at Stations AB20 and AB23. Minimum data-reporting frequency is hourly.

For the overwhelming majority of the time, SO_2, H_2S, and CO have indicated background levels below the lower level of significance of the instruments. Only for ozone and total suspended particulates have significant values been measured.

The highest and second highest peak hourly readings for ozone in 1978 were 82 and 80 ppb respectively; the ozone standard in 1978 was 80 ppb. Inasmuch as 2 ppb is within the error bounds of C-b's instrument (Volume 2), no violation of this standard has been demonstrated. The peak 24-hour reading for particulates was 64 $\mu g/m^3$, well below the standard.

Ozone-concentration shifts to high values show correlation with weather-related meteorological parameters. High particulate concentrations to date are judged to be due solely to fugitive dust. Time series plots do not identify any discernible trends in either gaseous constituents or particulates over time, except for some seasonal variations in particulates. Particulate concentrations are usually highest in spring and fall with minimums in winter. No specific dependence of concentrations on wind speed or direction has been noted.

Mean annual visual range in 1978 was 130 km (81 miles), with a seasonal Spring minimum of 126 km (78 miles) and Fall maximum of 138 km (86 miles). No significant change in the annual mean has been noted since the 1975-1976 measurements.



AMBIENT AIR QUALITY DEVELOPMENT MONITORING NETWORK

Note: ( ) = Systems Dependent

FIGURE 12-5

12.6 Meteorology

Climatological records indicate an annual mean temperature of 6-7° C. over the past 4 years. Time series analyses of monthly means has demonstrated no trend in long-term mean values. Cold air drainage results in winter minima in Piceance Valley near -43° C. Although 1977 was the wettest of the 4 years (35.7 cm), its distribution was such that it came too late in the year to be a major influence on productivity. Lightest annual precipitation was 23.6 cm in 1976. Peak storm intensities reached 4.3 cm precipitation on September 3, 1977.

Predominate winds on Tract continue to be from the south-southwest with Spring and Summer showing higher wind speeds (5-8 m/sec) than Fall and Winter (1-3 m/sec) at the 10 meter level above the surface. Winds from the Tract direction generally become channeled by Piceance Valley walls toward the WNW downstream direction of Piceance Creek during late afternoon and night; directions reverse in daytime. Air is typically stable during night and early morning and unstable in late morning and afternoon.

12.7 Noise

The environmental noise program deals with both traffic and tract-generated noise levels. The discrete (weekly) traffic noise level measurements indicated noise levels approximately 9 dbA above baseline peaks. Continuous noise measurements (every 6th day) indicate no significant increases due to the tract activities in average noise levels for two 12-hour periods (7 p.m.-7 a.m. and 7 a.m.-7 p.m.).

12.8 Wildlife Biology

With regard to deer counts observed along Piceance Creek, maximum weekly counts since baseline have always occurred in spring and have varied from 1512 in 1976 to 1034 in 1978 with 1975 and 1977 values intermediate to these. Road kills in any week usually vary from less than 1% to 1.5% of those counted in any given week. A total of 125 deer were killed along the road from September 1977 to May 1978. Use of company buses has been the principal mitigative measure in reducing traffic on Piceance Creek road. Regarding natural deer mortality in lateral draws and gulches, fawns have comprised 80% of deer mortality each year. Age class composition for mule deer wintering near the tract is as follows: 79 fawns per 100 does, 26 bucks per 100 does, and 64 fawns per 100 adults.

Regarding medium-sized mammals, fewer coyotes and more cottontail rabbits were noted in 1978 than in 1977. The deer mouse continues to be the most prevalent small-mammal species found on the Tract.

As with previous sampling periods, greater avian songbird diversity has been noted in pinyon-juniper woodlands as opposed to chained pinyon-juniper; similarly more mourning doves were found in the unchained habitats. Nesting raptors in the tract vicinity in 1978 consisted of red-tailed hawks and

great-horned owls. Although bald eagles have been observed in the tract vicinity, none nested or remained in the area; they were merely flying through. No threatened or endangered species were found on or near the Tract.

12.9 Vegetation

Monitoring data suggest that over the past four years there have been no major changes in species composition or community structure in the chained rangelands. The general trend has been for a slight increase in total cover and also for an increase in the density of big sagebrush. These changes are closely related to the successional characteristic of the chained rangelands. The trend for increasing shrub cover and density is likely to continue until the tree saplings mature into tree-size individuals.

The production patterns within the vegetation types observed during the Development Monitoring period are the same as those observed during the baseline period. Utilization continues to be seasonal and by mid-growing season is nearly non-detectable because of livestock use patterns. Observed differences in productivity between intensive study plots appear to be more related to site differences than to any development-related activities. Herbaceous production is closely related to precipitation; significant differences in production between years are related to differences and fluctuating patterns of precipitation in this semi-arid region.

Total production from range cages in pinyon-juniper woodlands averaged 21.4 g/m^2 and only 9.8 g/m^2 in open areas. In both cases most of the production was attributable to perennial grasses. In chained rangeland production was 63.5 g/m^2 in cages and 53.2 g/m^2 in open areas. Upland sage averaged 68.0 and 47.2 g/m^2 for the closed and open areas respectively.

Fertilization of upland chained areas appears to result in an increase in herbaceous production. Because of a limited sample size and high data variability, the differences between fertilized areas and control areas were not significant. Shrub production and utilization (bitterbrush and mountain mahogany) for this past year differed markedly from those of 1976-1977 in that production was lower and utilization by mule deer was much higher. See Figure 12-6. Precipitation distribution was more favorable to productivity in 1978 than in 1977.

Revegetation monitoring will be conducted on sites which have undergone surface disturbance and on future raw-shale disposal sites. Erosion control and rehabilitation are discussed in Part 1, including the reclamation activity scheduled defining affected areas, disturbance timetable, reclamation time span, and disturbed acreage.

12.10 Ecosystem Interrelationships

Ecosystem interrelationship studies have been initiated as a means of assessing the potential impact of environment perturbations resulting from development activity. Quantitative studies to date included: (1) effects of climatic variations on herbaceous productivity; (2) effects of traffic, climate,

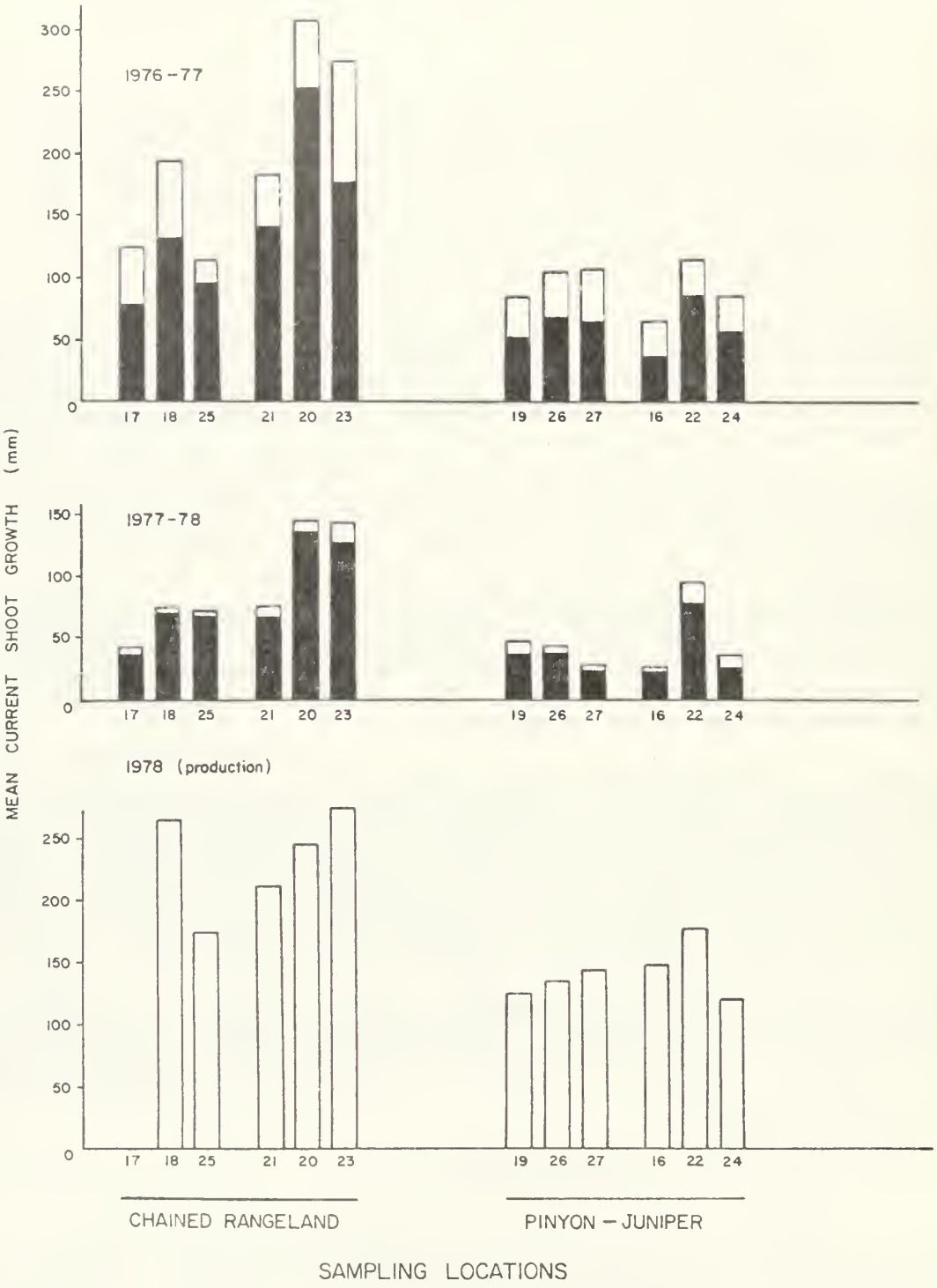


FIGURE 12-6 Trends in production and utilization of bitterbush. Shaded areas and figures represent the percent of current shoot growth consumed by deer. Transect numbers are indicated below bars.

and size of mule-deer herd on deer road-kill; and (3) effects of urbanization on watershed hydrologic response time. Principal results established were as follows: (1) herbaceous productivity correlated best with precipitation in April-May-June and total precipitation of the previous year; (2) deer road-kill correlated best with deer road-count; (3) a lag time of 5.5 hours was demonstrated to exist currently between a precipitation event and peak flow on Piceance Creek below the tract; future analyses will determine potential effects of urbanization on this lag or response time.

12.11 Items of Pre-historic and Historic Interest

Recent developments regarding items of pre-historic or historic interest have been primarily associated with a planned route for a powerline from Meeker to the Tract. One pre-historic site and five isolated "finds" were located near the proposed right-of-way; mitigation will be accomplished by avoiding these sites through minor rerouting.

12.12 Health and Safety

With regard to health and safety, accident frequency analyses and inspection reports (Mine Safety and Health Administration and Colorado Division of Mines) are included in the Development Monitoring Plan and its reports. At C-b based on 442,218 man-hours, there were 3 lost-time accidents totaling 7 lost-time days. The site injury rate in 1978 was 1.35 (incidents/200,000 man-hours) and the severity measure using 3.16 which compare favorably with the national average for underground mines of 16.32 and 23.0 respectively.

VOLUME 1

ADDENDA AND ERRATA

1. Page 14 Section 4.2.4 First Sentence - "hoist" should be "house"

2. Page 14 Section 4.2.6 Second Sentence - "Figure 4-2" should be "Figure 4-3". Note that these ponds were not completed by 12/31/78.

3. Page 15 Caption "V/E SHAFT" should be "MINE SUPPORT"

4. Page 21 Section 6.1 See also item 5 below:

5. Addenda:

   To fully comply with 43CFR23.1, the AOSO was provided the information below on April 9, 1979 as part of C-b's operations report. For convenience, it is repeated here as part of the 1978 C-b Annual Report; it supplements the material in Section 8.9.

RECLAMATION STATUS AND ACTIVITIES

The number of acres affected during the year 1978 (as depicted on Table 8-1) is 162. The number of acres reclaimed for the year is 15. It consists of stockpiled soil at the Mine Support Area and abandoned access road. These reclaimed acres are to be straw-mulched in the Spring of 1979.

The location and number of acres in the various stages of reclamation (backfilled, graded, topsoil replaced, revegetated) are as follows:

Number of acres - backfilled: In a continuing process, V/E Shaft Area (3 acres), and the initial berm into East No Name Gulch (1 acre) were backfilled.

- graded: All areas were graded (162 acres), except the water discharge and land application area (30 acres) south of the Mine Support Area. This area is under consideration by the Colorado Mined Land Reclamation Board.

- topsoil replaced: No topsoil was replaced. Topsoil was stored in two locations near the Mine Support Area, in two locations near the V/E Shaft Area, and on the abandoned access road (total 19 acres).

- revegetated: The two soil stockpiles near the Mine Support Area (5 acres), and access road including abandoned road (10 acres) were revegetated.

The species of vegetation planted, the locations, and approximate dates of planting are as follows:

1. Stockpiled soil area south of the Mine Support Area was seeded with permanent seed mixture (Table 1) for south facing slopes (3 acres). Date of planting - October, 1978.

2. Stockpiled soil area west of the Mine Support Area was seeded with permanent seed mixture (Table 1) for north facing slopes (2 acres). Date of planting - October, 1978.

3. Abandoned access road was seeded with the same mixture as that indicated above for north slopes. Date of planting - October, 1978.

4. Areas where continued activity permits only temporary mechanical rehabilitation include the Mine Support Area, V/E Shaft

Area, the present and future guard area, East-No-Name-Dam investigation area, explosives area, temporary soil stockpile, water discharge area east of the Mine Support Area, and the initial disposal berm.

Mechanical reclamation, as used here, is defined as the application of temporary seed mixture (annual and perennial ryegrass, yellow seed clover) followed by sprayed application of coherrex dust palliative on rocky areas; the dust palliative is also sprayed on haul roads and parking lots. The Mine Support Area, the V/E Shaft Area, the guard house, and the explosives area were seeded May 1978 (106 acres). All other reclaimed acres will be seeded in April 1979.

Fertilizer is not scheduled for application to the topsoiled areas until Fall, following seeding. Therefore, 5 acres of the soil stockpiled near the Mine Support Area and 10 acres along the access road are not scheduled until the Fall of 1979. Dust palliative (11,225 gallons) was mixed at a dilution rate of approximately 7:1 and applied to mechanically stabilized areas.

No seedings have been established long enough to evaluate.

TABLE 1 - SPECIES LIST FOR C-b RECLAMATION

	Species		Lbs/Acre Drilled: North & East Facing Slopes and Level Areas	Lbs/Acre Drilled: South & West Facing Slopes
Grasses:	* Agropyron cristatum	- crested wheatgrass	1	1
	* A. elongatum	- tall wheatgrass	-	1
	* A. spicatum var. inerme	- beardless bluebunch wheatgrass	2	2
	* A. smithii (rosana)	- western wheatgrass	1	2
	* A. intermedium (amur)	- intermediate wheatgrass	1	1
	* Bromus marginatus	- mountain brome	1	-
	* Elymus cinereus	- Great Basin wildrye	1	-
	* E. junceus	- Russian wildrye	1	1/2
	* Festuca ovina	- hard sheep fescue	1	-
	* Oryzopsis hymenoides	- Indian ricegrass	-	1
Forbs:	* Hedysarum boreale (Utah)	- Utah sweetvetch	1/2	1/2
	* Medicago sativa	- alfalfa	1	1/2
	* Penstemon sp.	- penstemon	1/2	1/2
Shrubs:	† Amelanchier spp.	- serviceberry	-	-
	†* Artemisia tridentata	- big sagebrush	1/2	-
	* Atriplex canescens	- four wing saltbrush	-	2
	* A. confertifolia	- shadscale	-	1
	†* Cercocarpus montanus	- mountain mahogany	1	1/2
	* Cowania mexicana	- stansberry cliffrose	1	1/2
	* Ceratoides lanata	- winterfat	-	1
	†* Purshia tridentata	- bitterbrush	1	1/2
	† Symphoricarpos oreophilus	- snowberry		
Trees:	† Juniperus osteosperma	- Utah juniper		
	† J. scopulorum	- Rocky Mountain juniper		
	† Pinus edulis	- pinyon pine		
		Total	13-1/2 Lbs/Acre	15-1/2

* Seed (P.L.S. - Pure Live Seed)

† Transplants (40 per acre) will be placed selectively; (North and East facing slopes and level areas), transplants will total 320 per acre.

Note - Forb seed will be innoculated with Northrup King innoculator